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Turner et al.

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(54) **APPAREL INCORPORATING A PROTECTIVE ELEMENT**

(71) Applicant: **NIKE, Inc.**, Beaverton, OR (US)

(72) Inventors: **David Turner**, Portland, OR (US);
Daniela Grogro, Portland, OR (US)

(73) Assignee: **NIKE, Inc.**, Beaverton, OR (US)

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Related U.S. Application Data

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A41D 13/015 (2006.01)
A41D 13/05 (2006.01)

(52) **U.S. Cl.**
CPC **A41D 13/015** (2013.01); **A41D 13/0506** (2013.01); **A41D 13/0593** (2013.01)

(58) **Field of Classification Search**

CPC A41D 1/06; A41D 1/08; A41D 13/065; A41D 13/0506; A41D 13/0015; A41D 1/04; A63B 17/1225; F41H 1/02; A41B 1/00; A41B 9/02
USPC 2/227, 228, 22, 23, 267, 2.5, 465, 69, 2/910, 102, 115, 404, 405
See application file for complete search history.

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Primary Examiner — Tejash Patel

(74) *Attorney, Agent, or Firm* — Shook, Hardy & Bacon L.L.P.

(57) **ABSTRACT**

An article of apparel may include a garment portion and at least one protective element. The garment portion and the protective element have a configuration that forms a gap, separation, or pleat structure through, for example, folding or overlapping of a textile element of the garment portion. The gap, separation, or pleat structure may permit the protective element to move independent of other portions of the apparel, thereby enhancing a range of movement of the individual and the overall comfort of the apparel.

20 Claims, 30 Drawing Sheets

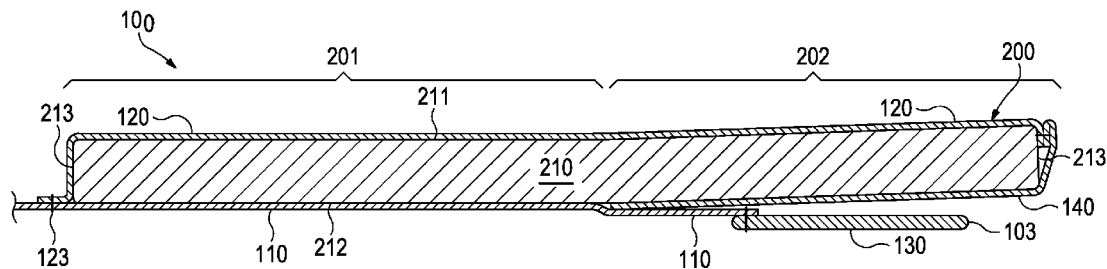
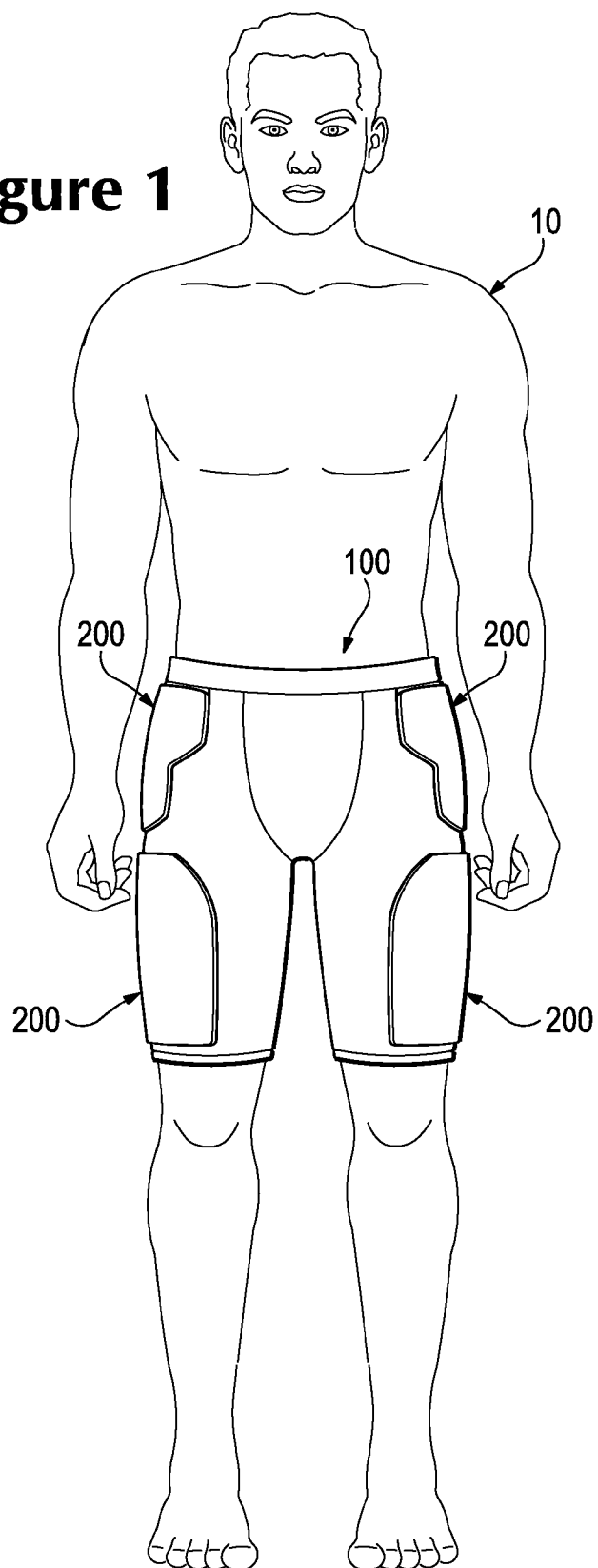


Figure 1

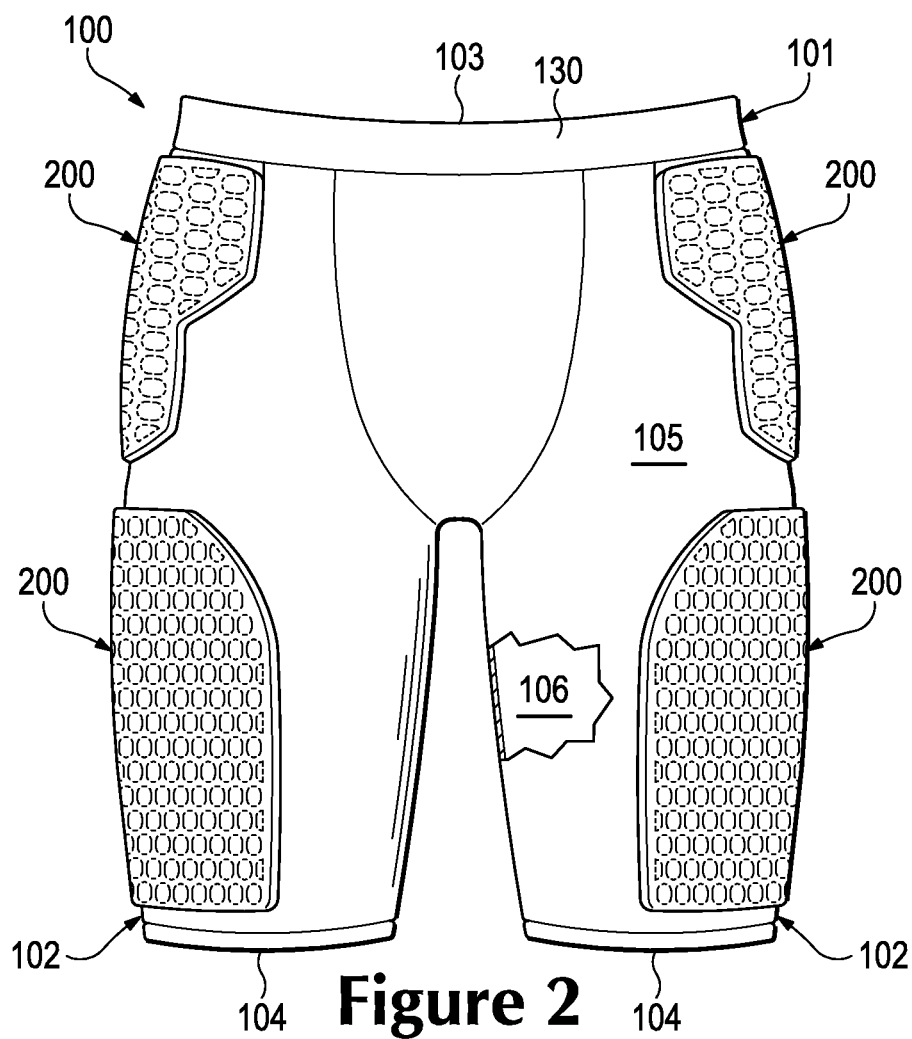


Figure 2

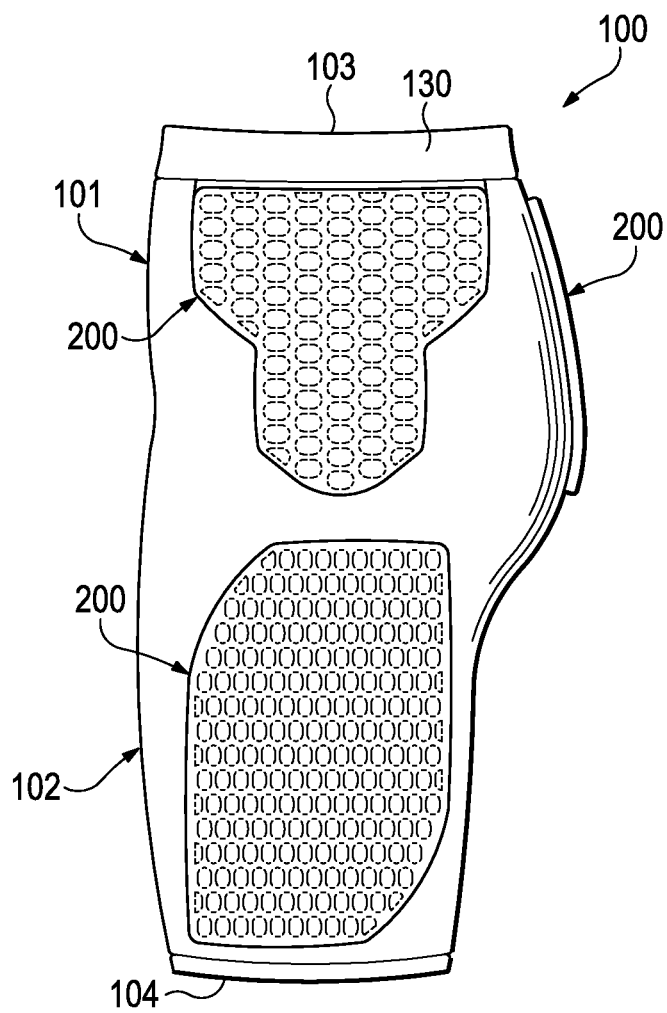


Figure 3

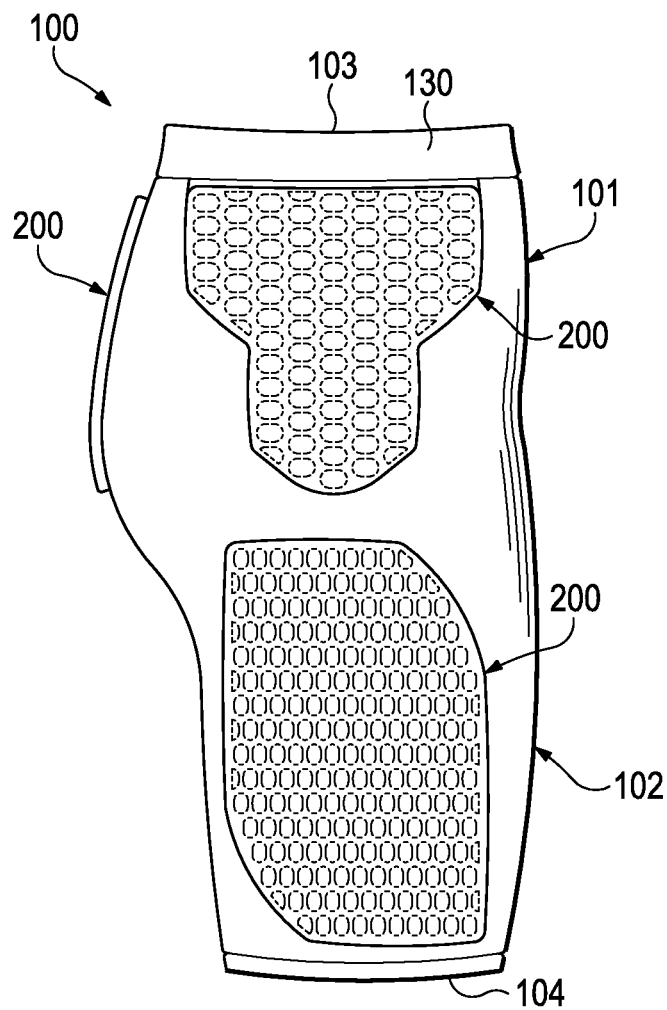


Figure 4

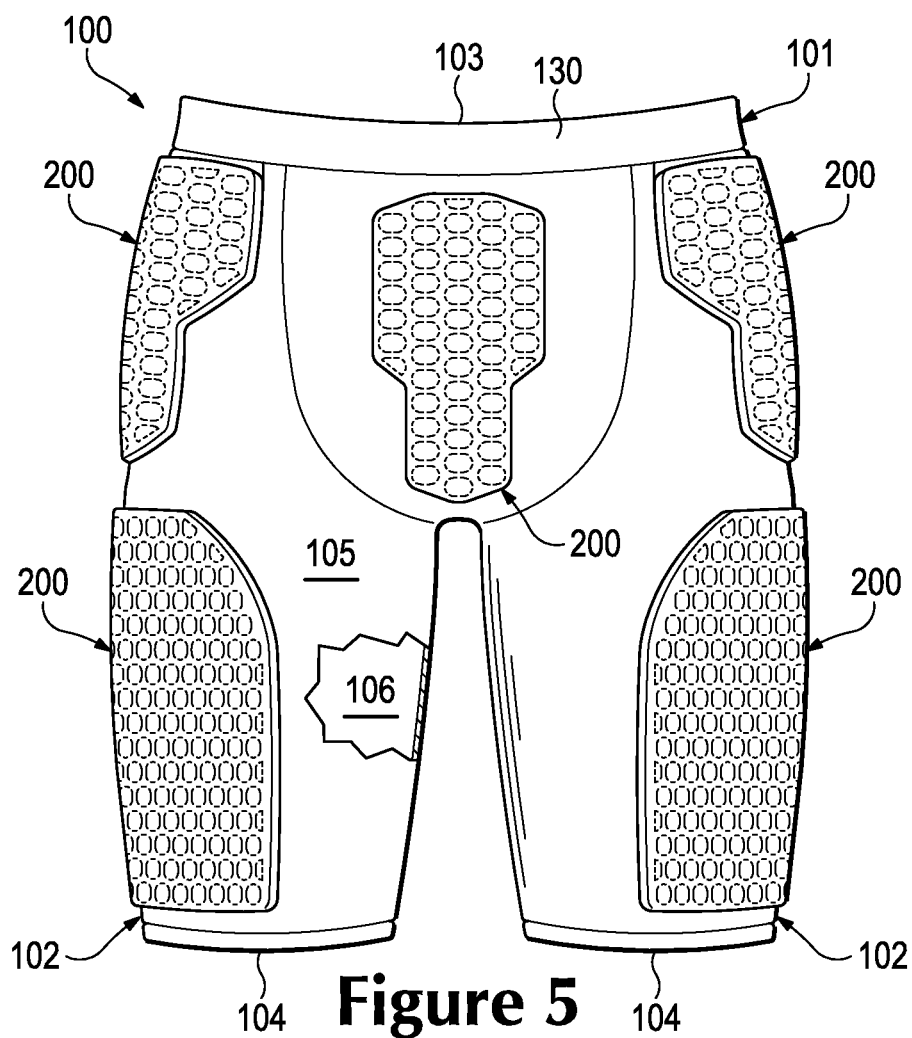
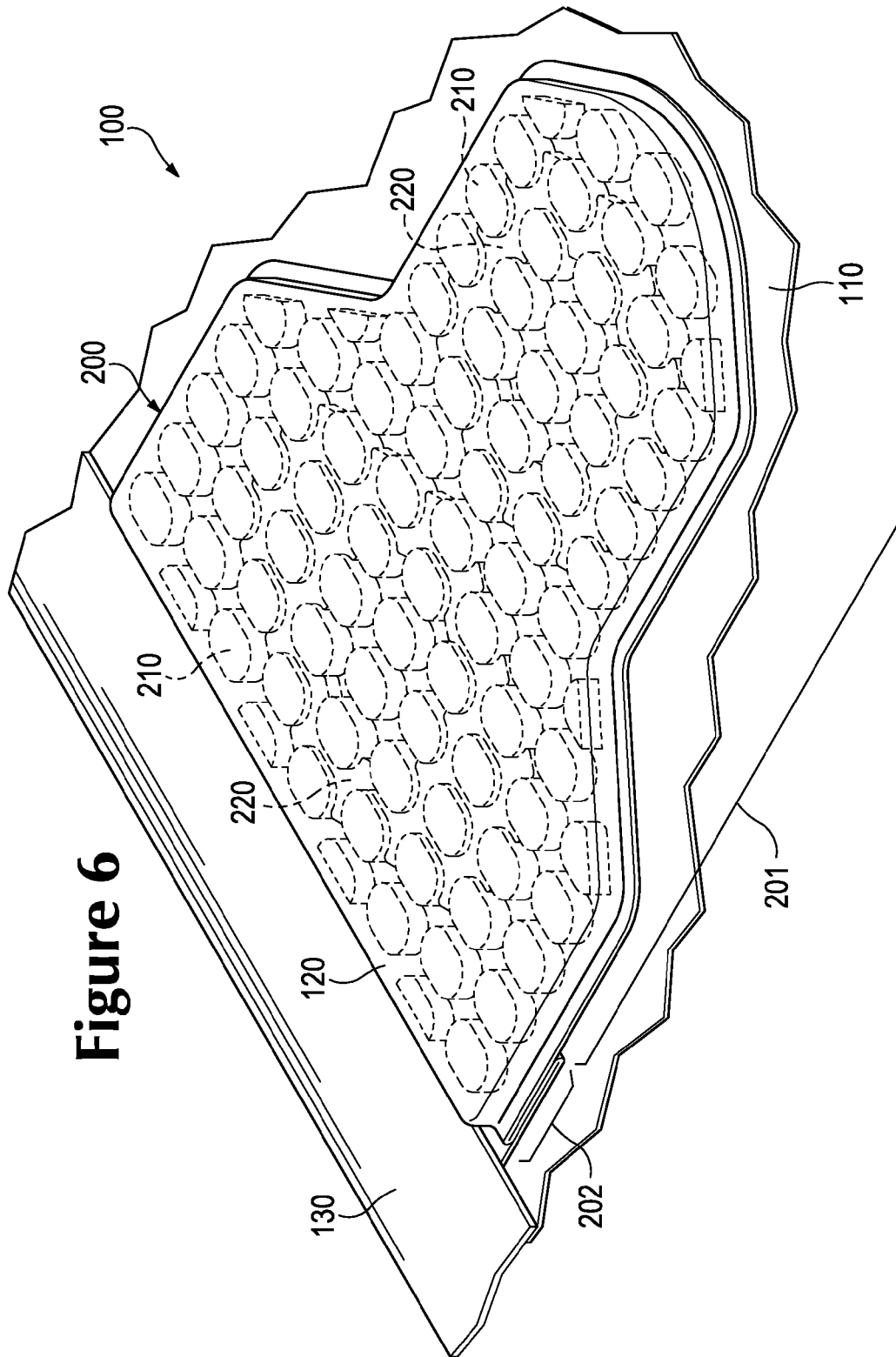


Figure 5



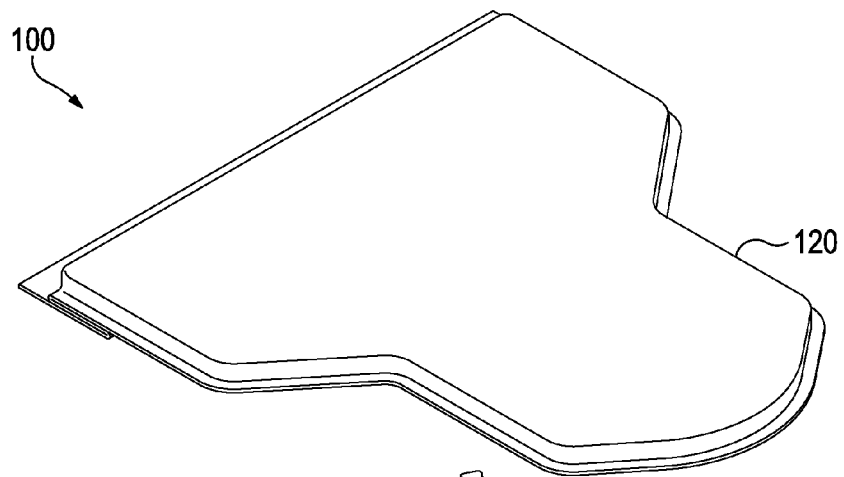
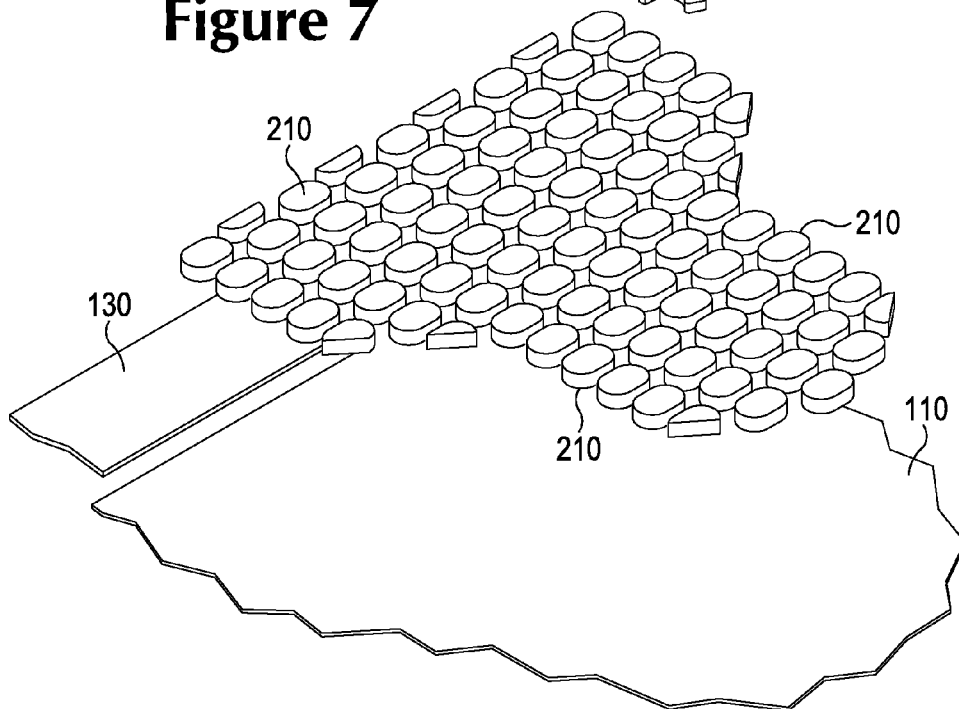


Figure 7



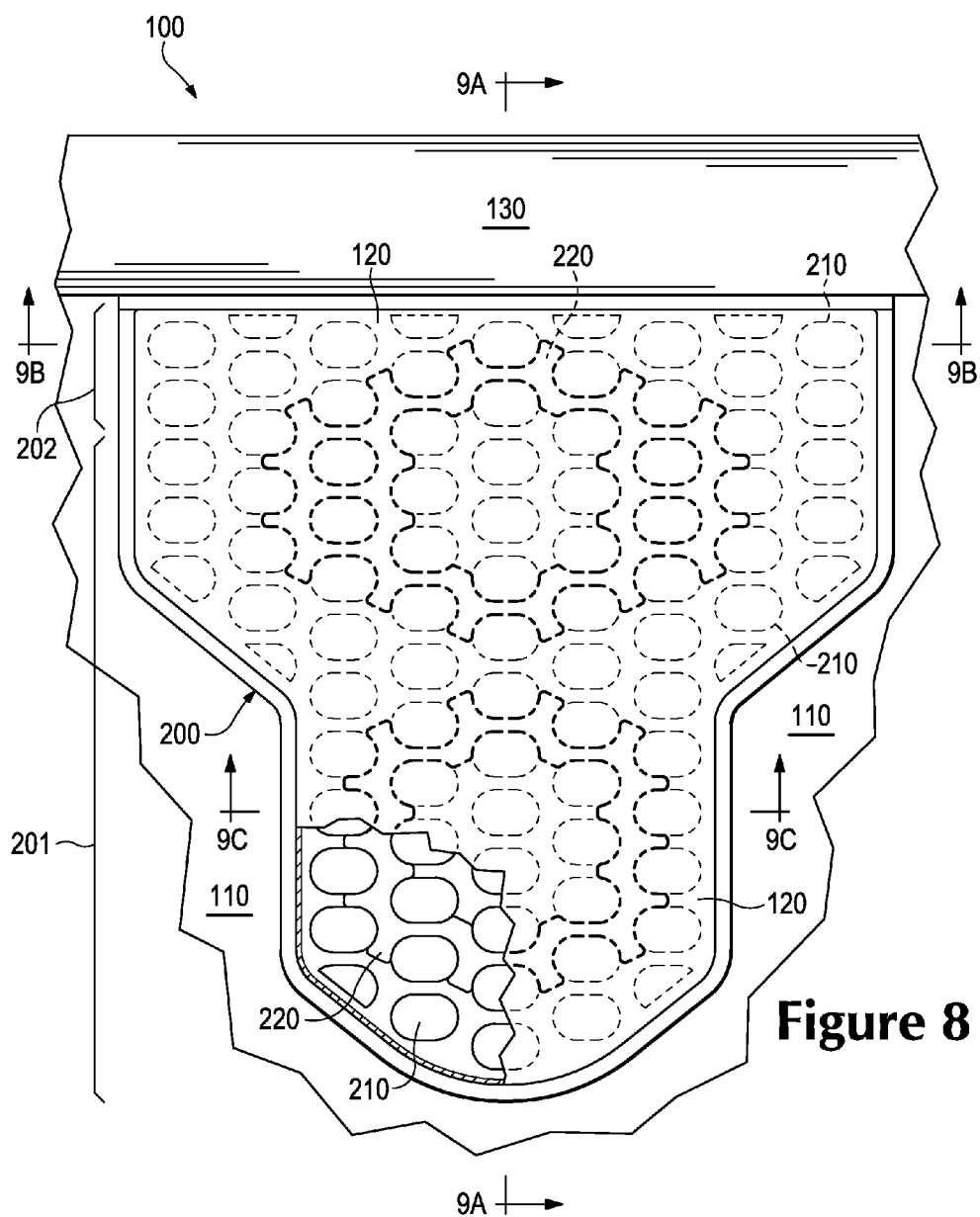


Figure 8

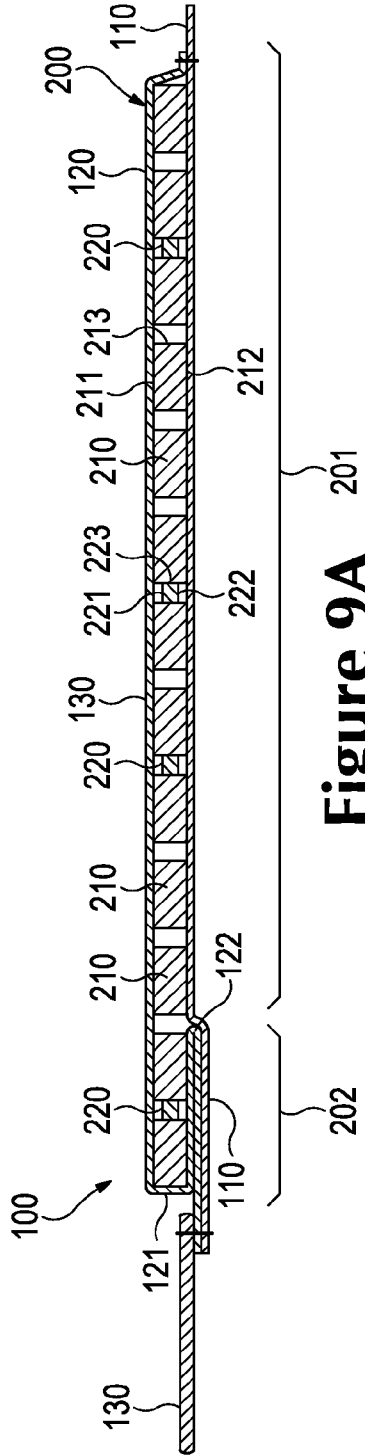


Figure 9A

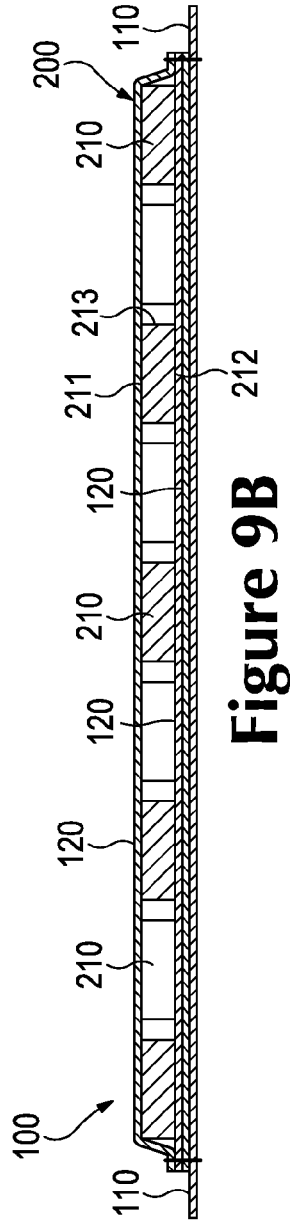


Figure 9B

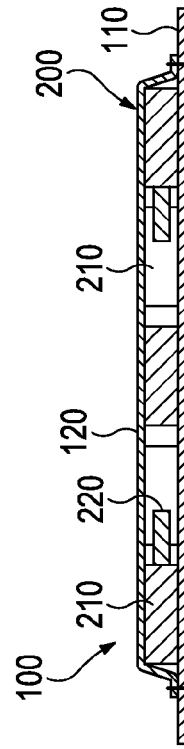
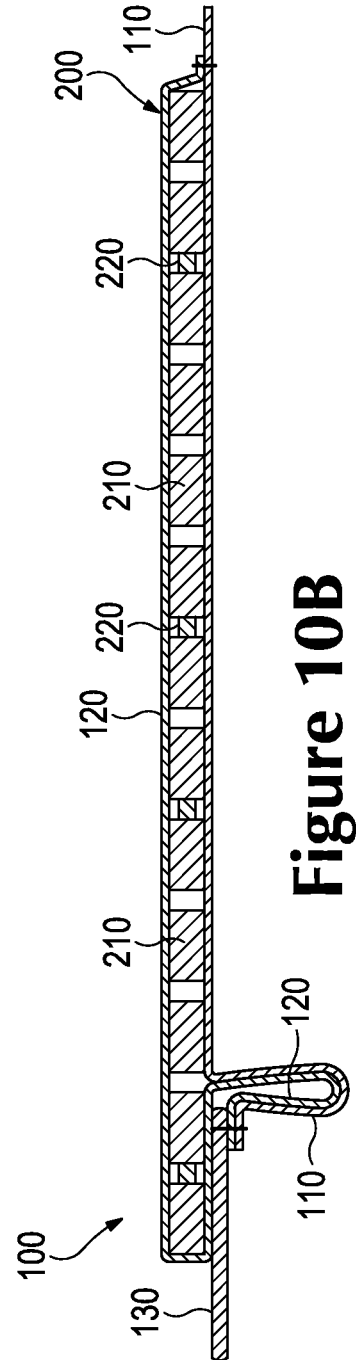
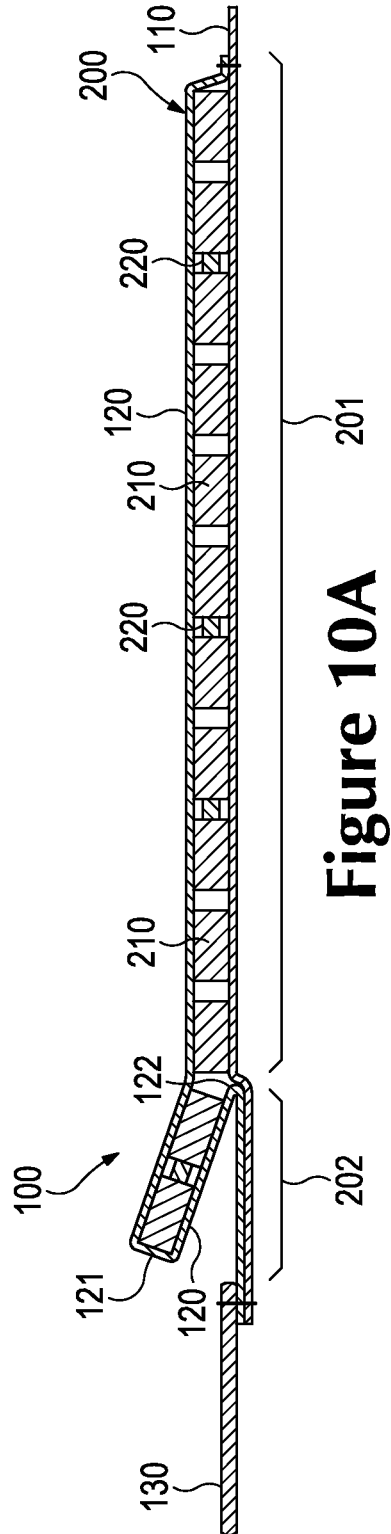


Figure 9C



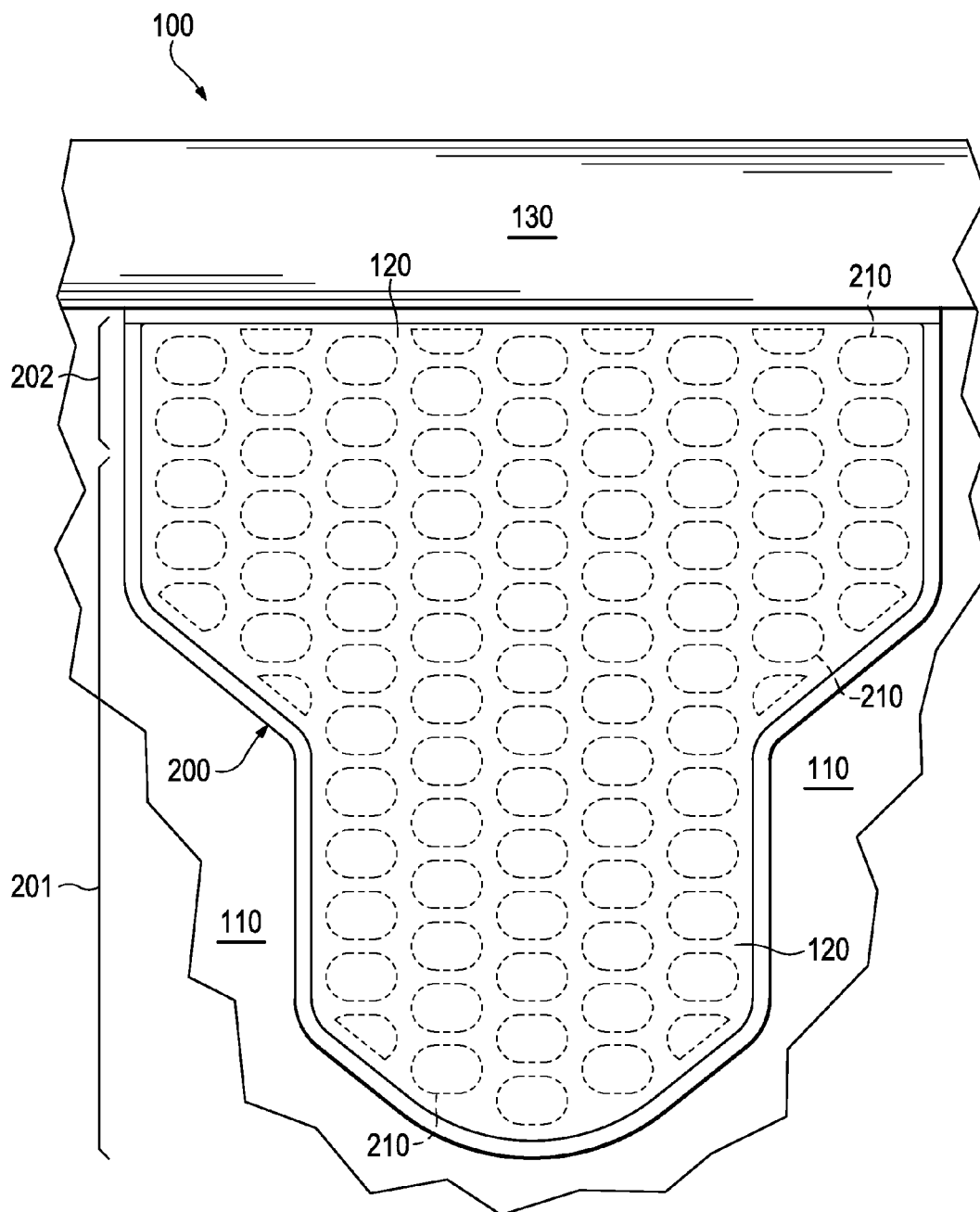


Figure 11A

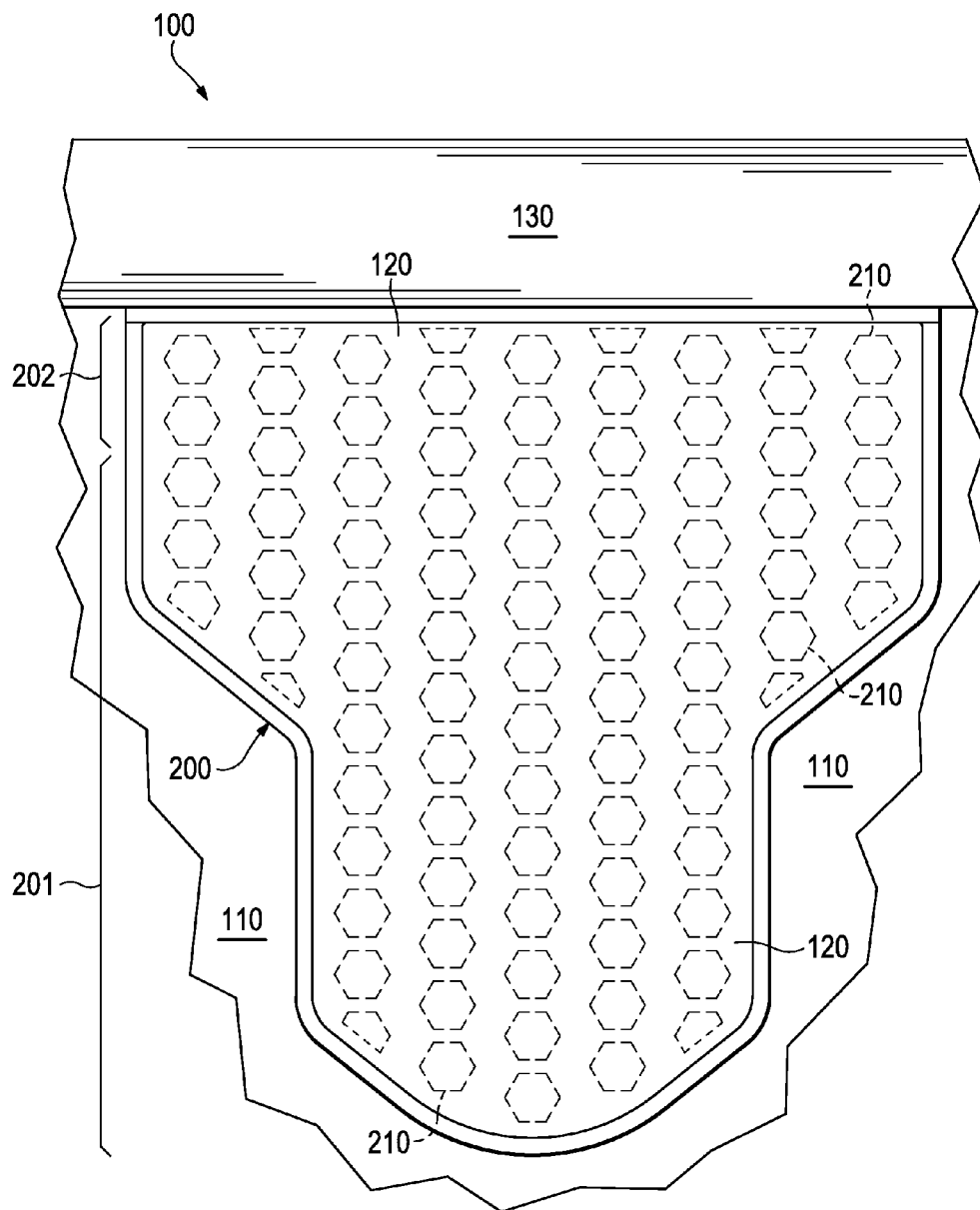


Figure 11B

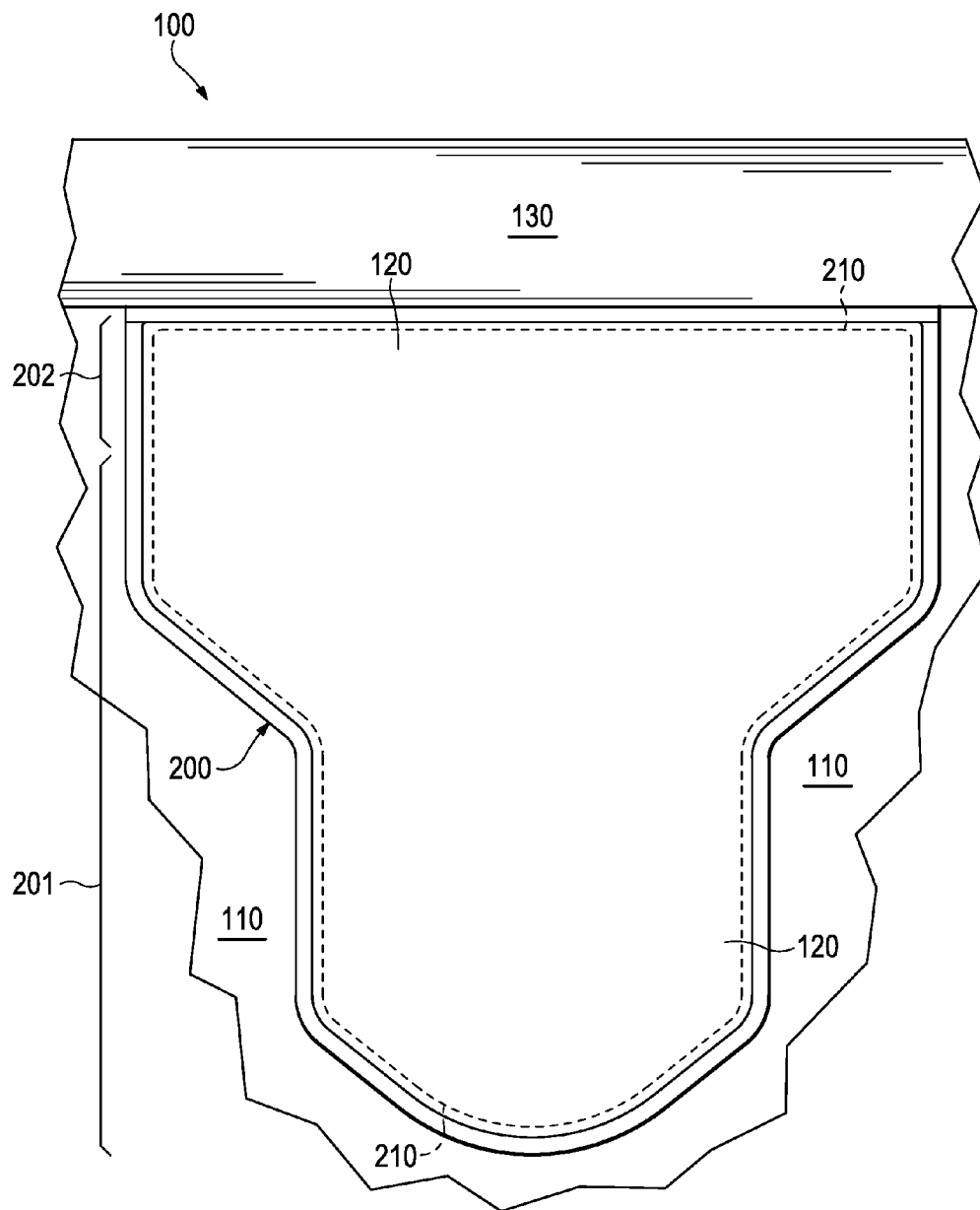


Figure 11C

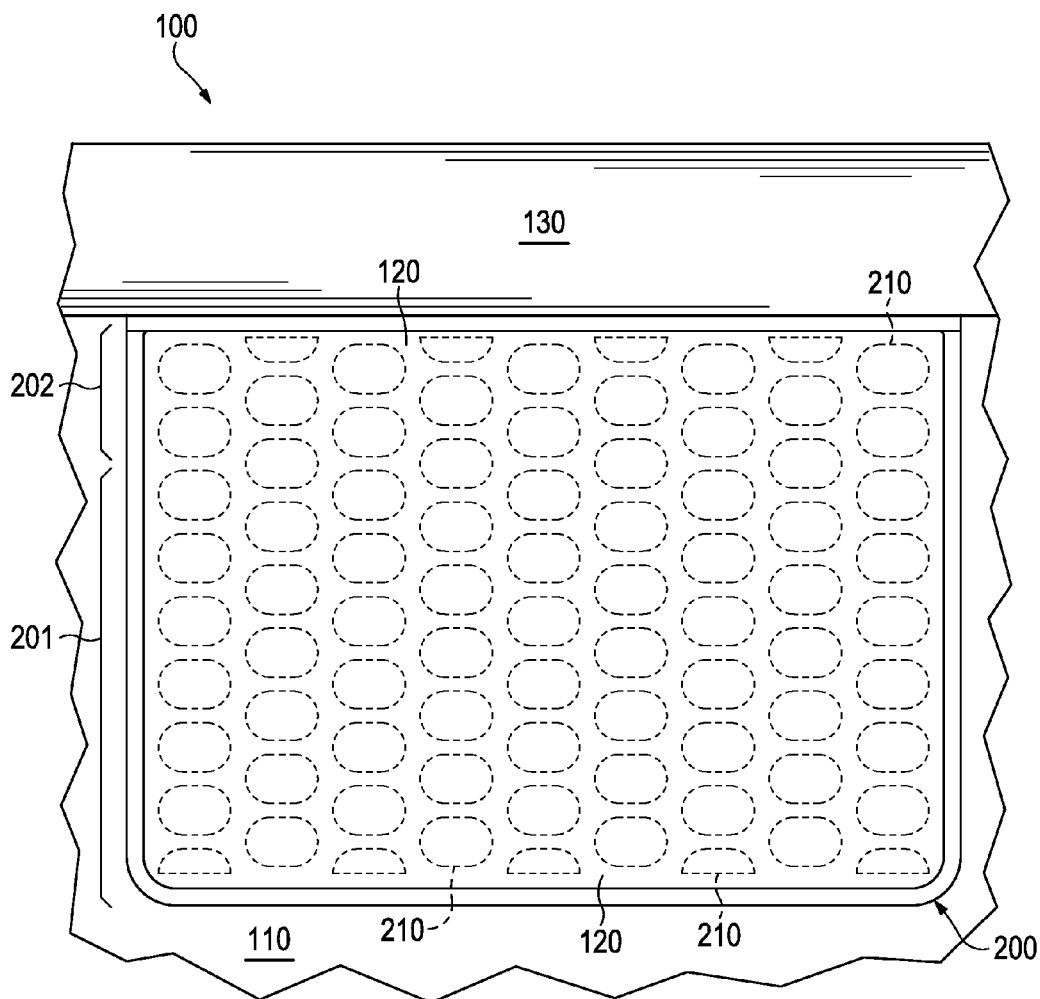


Figure 11D

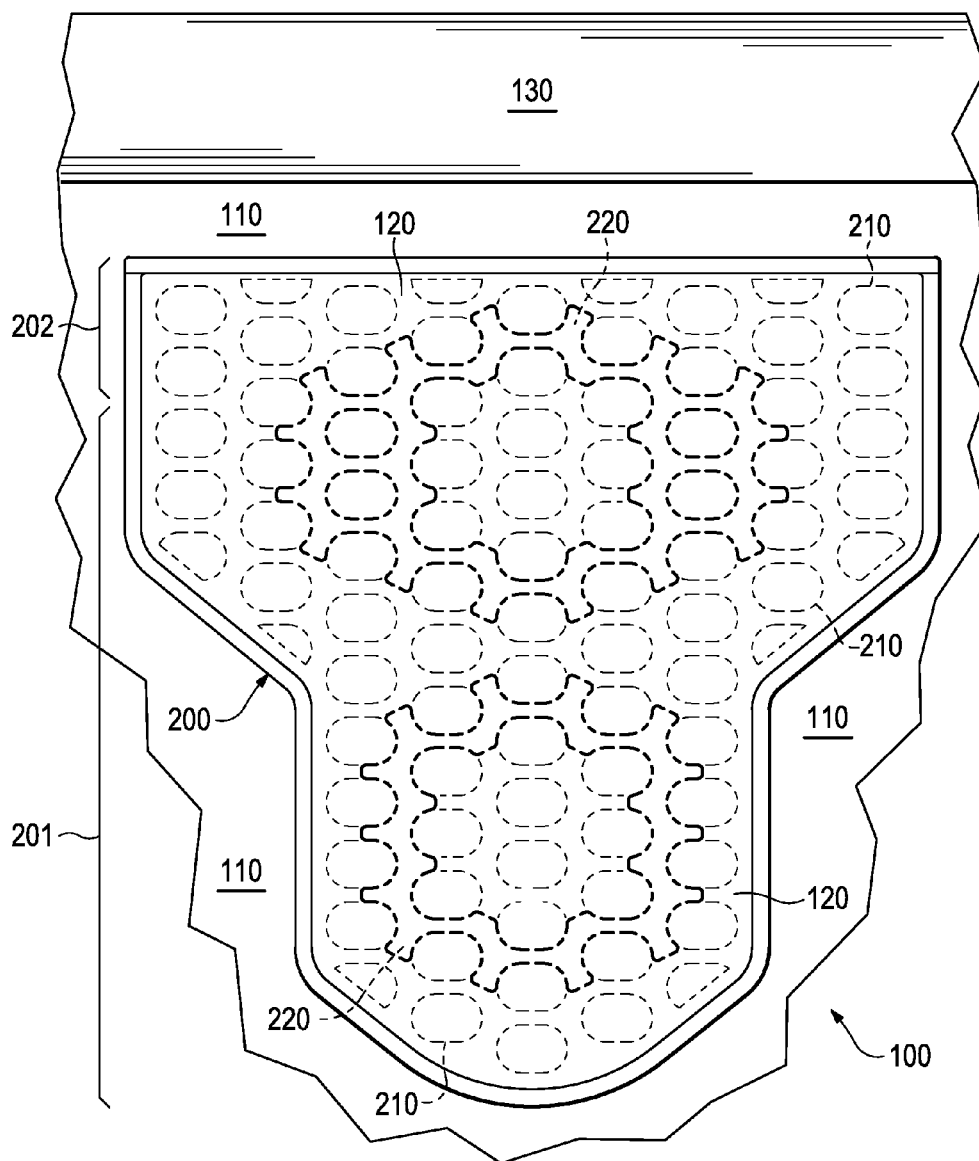


Figure 11E

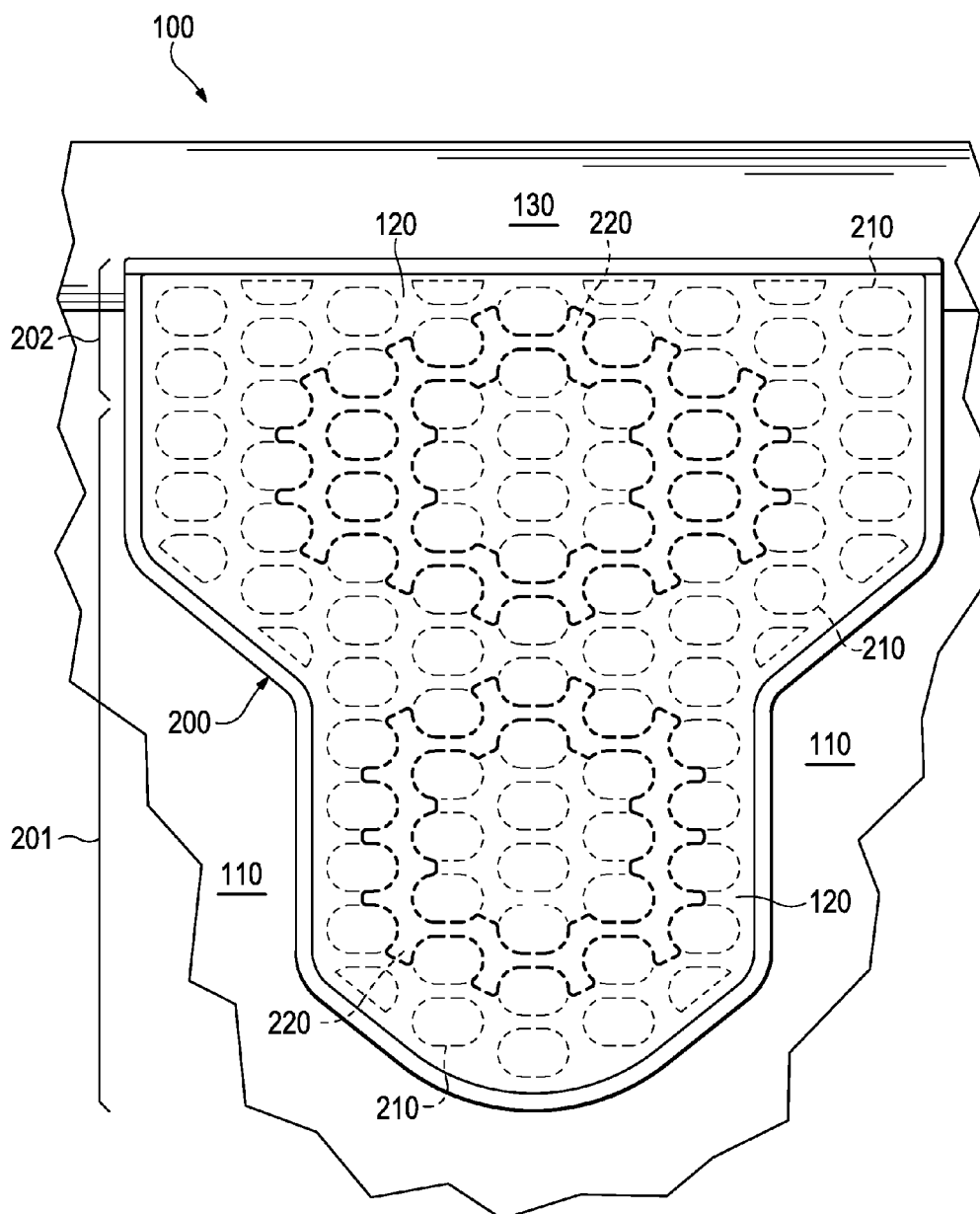
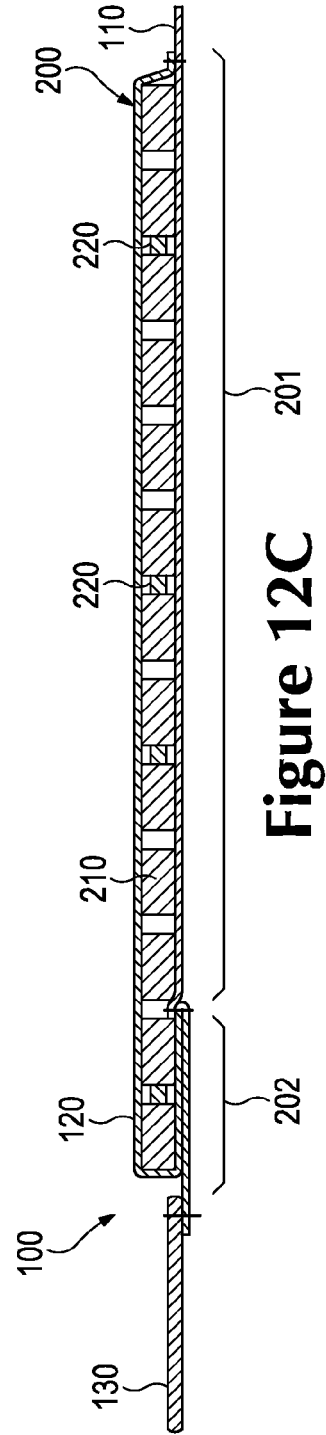
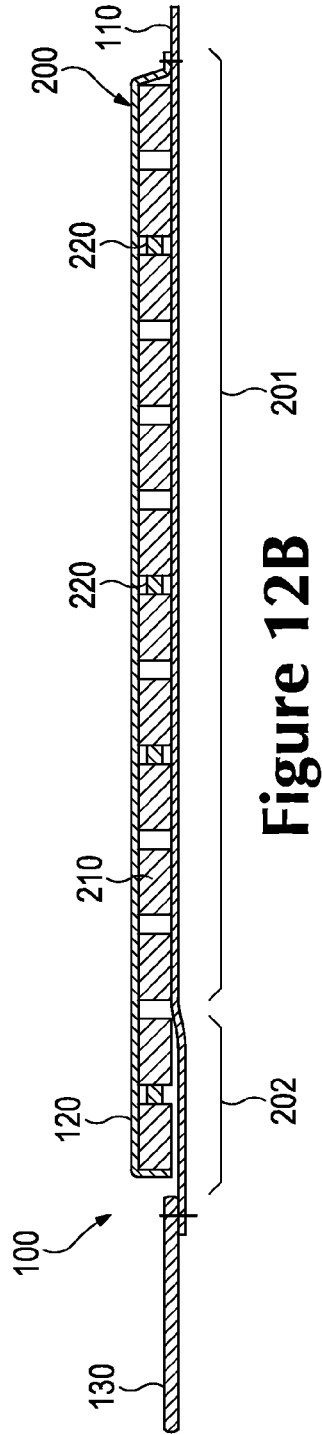
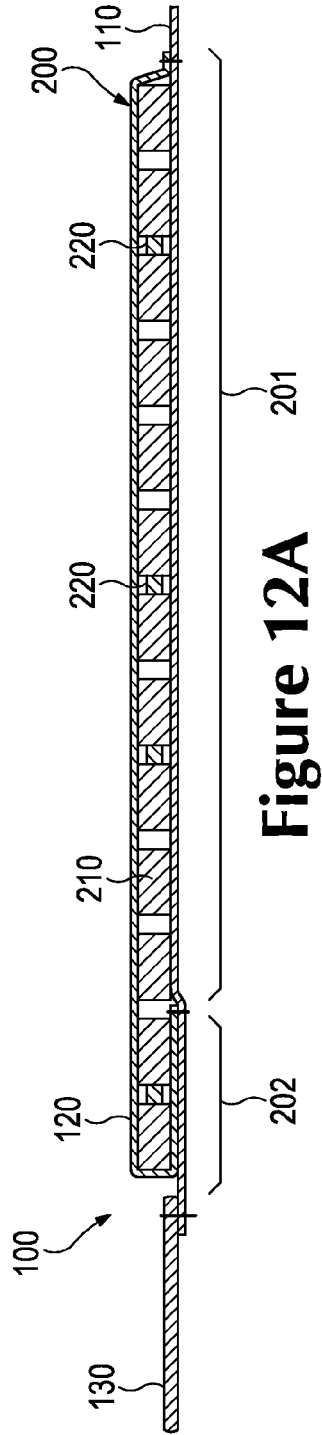


Figure 11F



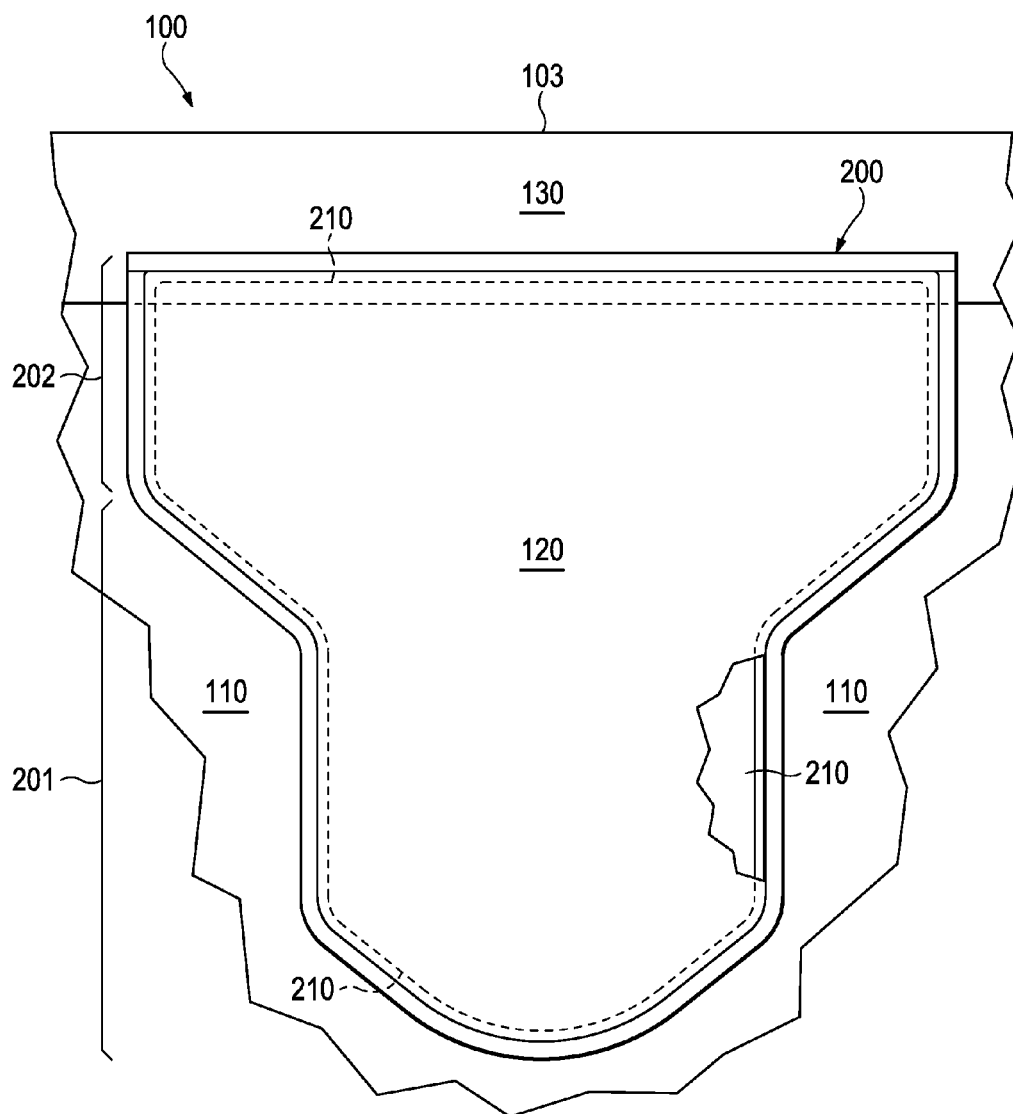


Figure 13A

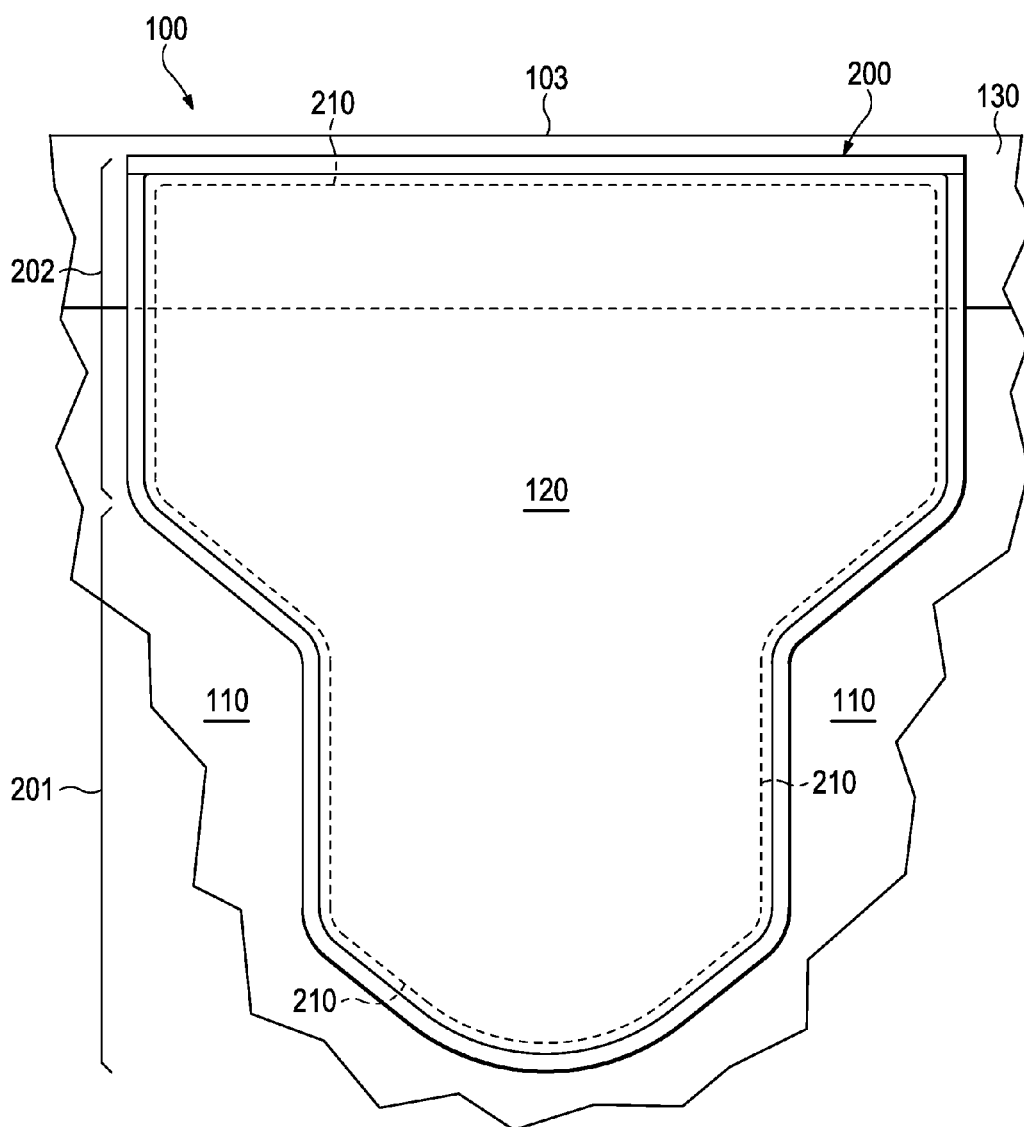


Figure 13B

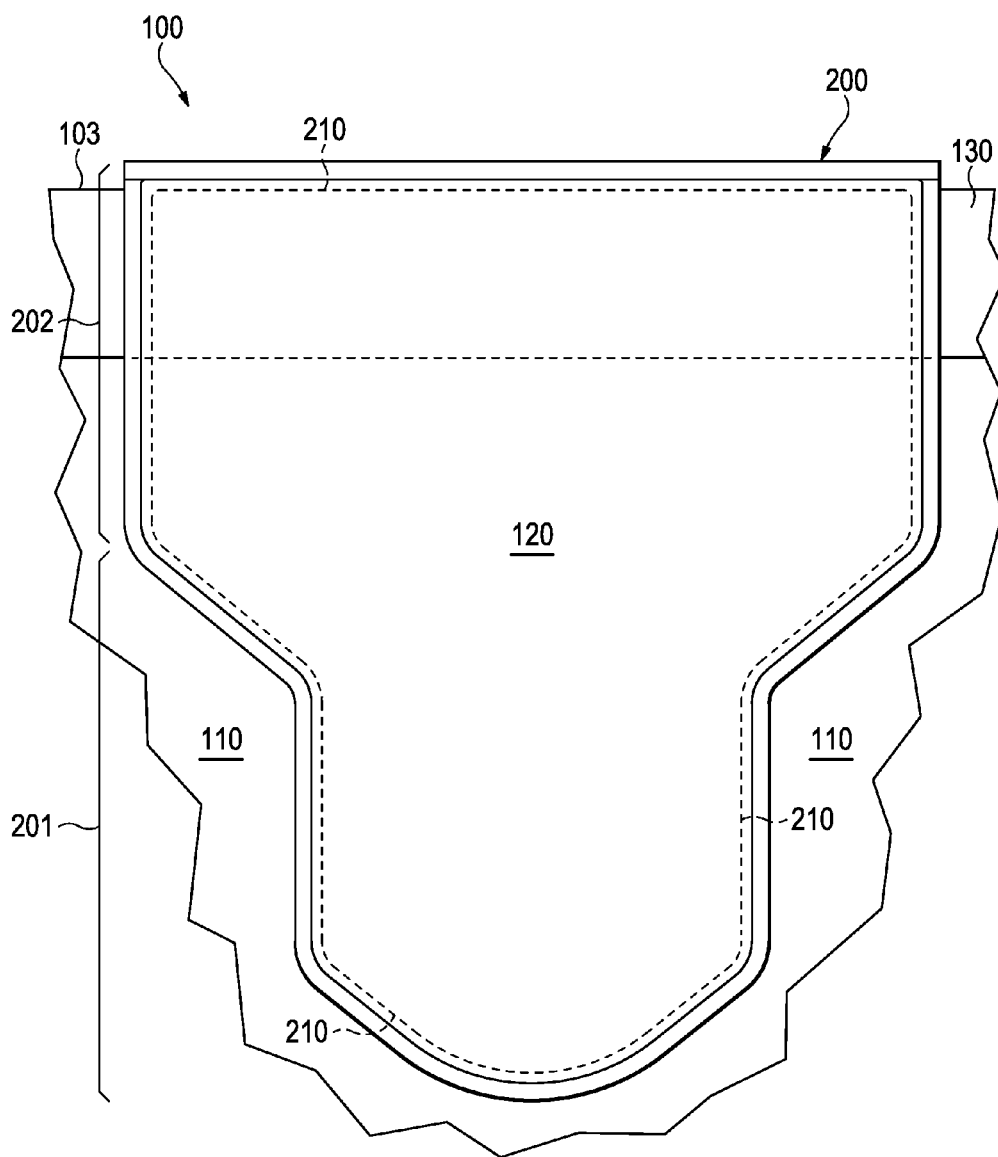


Figure 13C

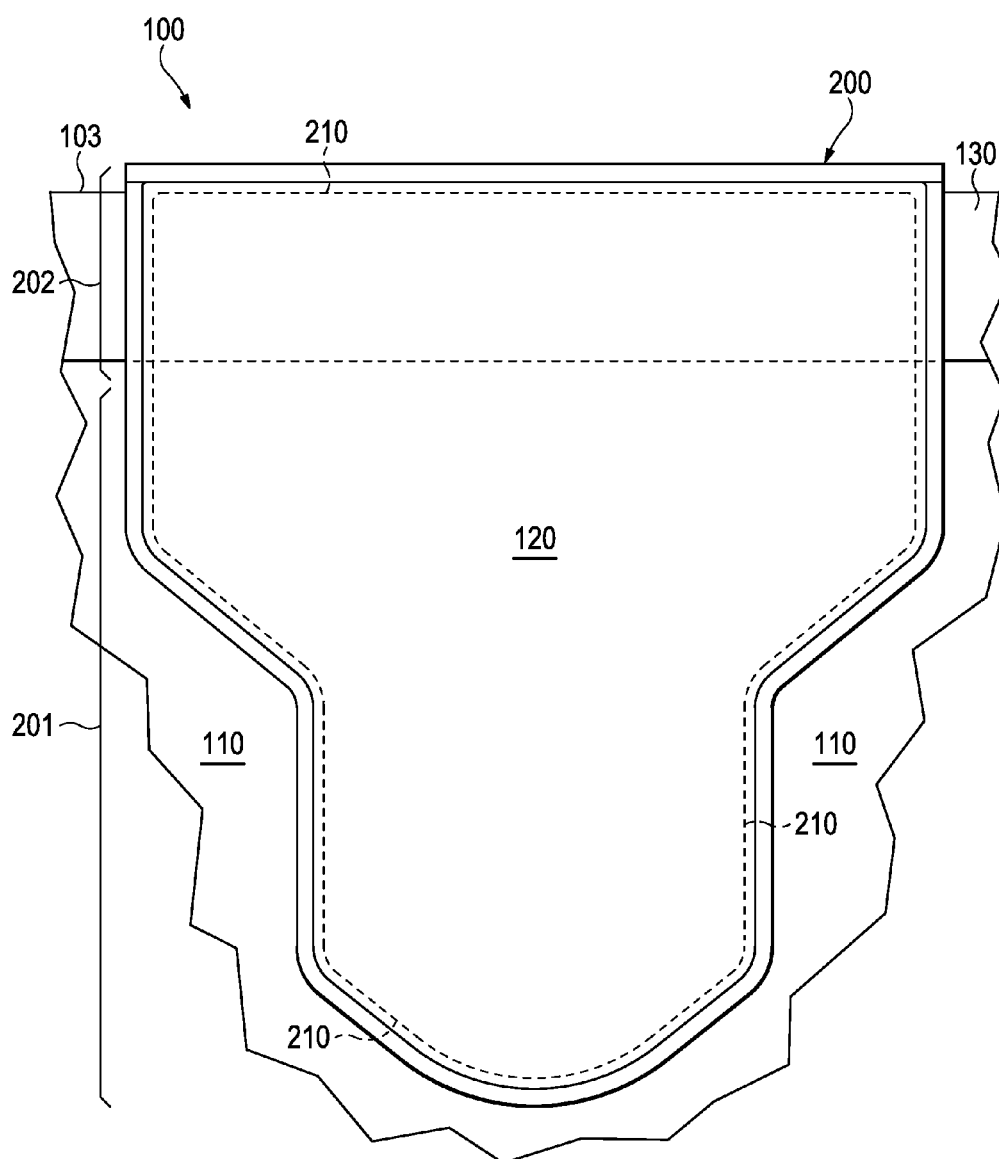


Figure 13D

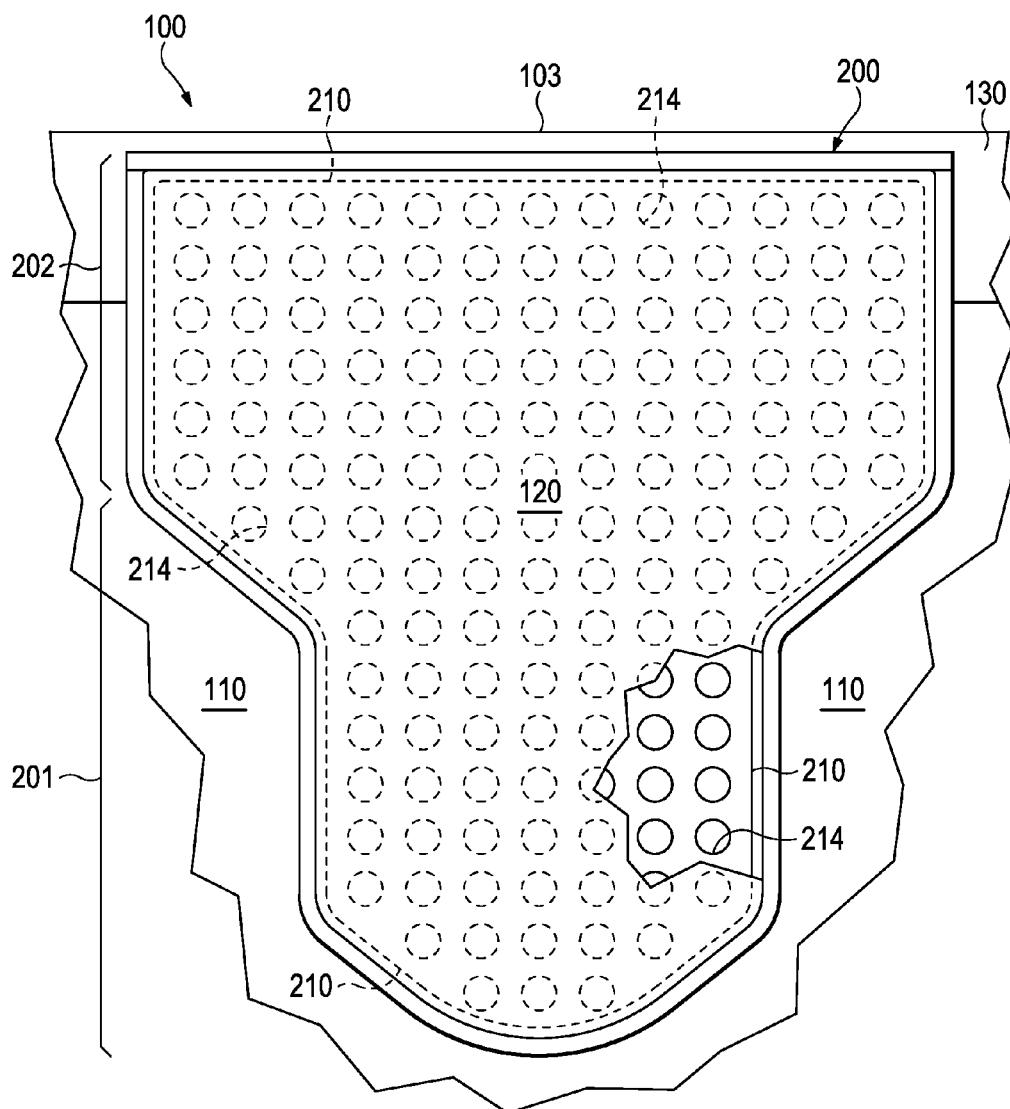


Figure 14A

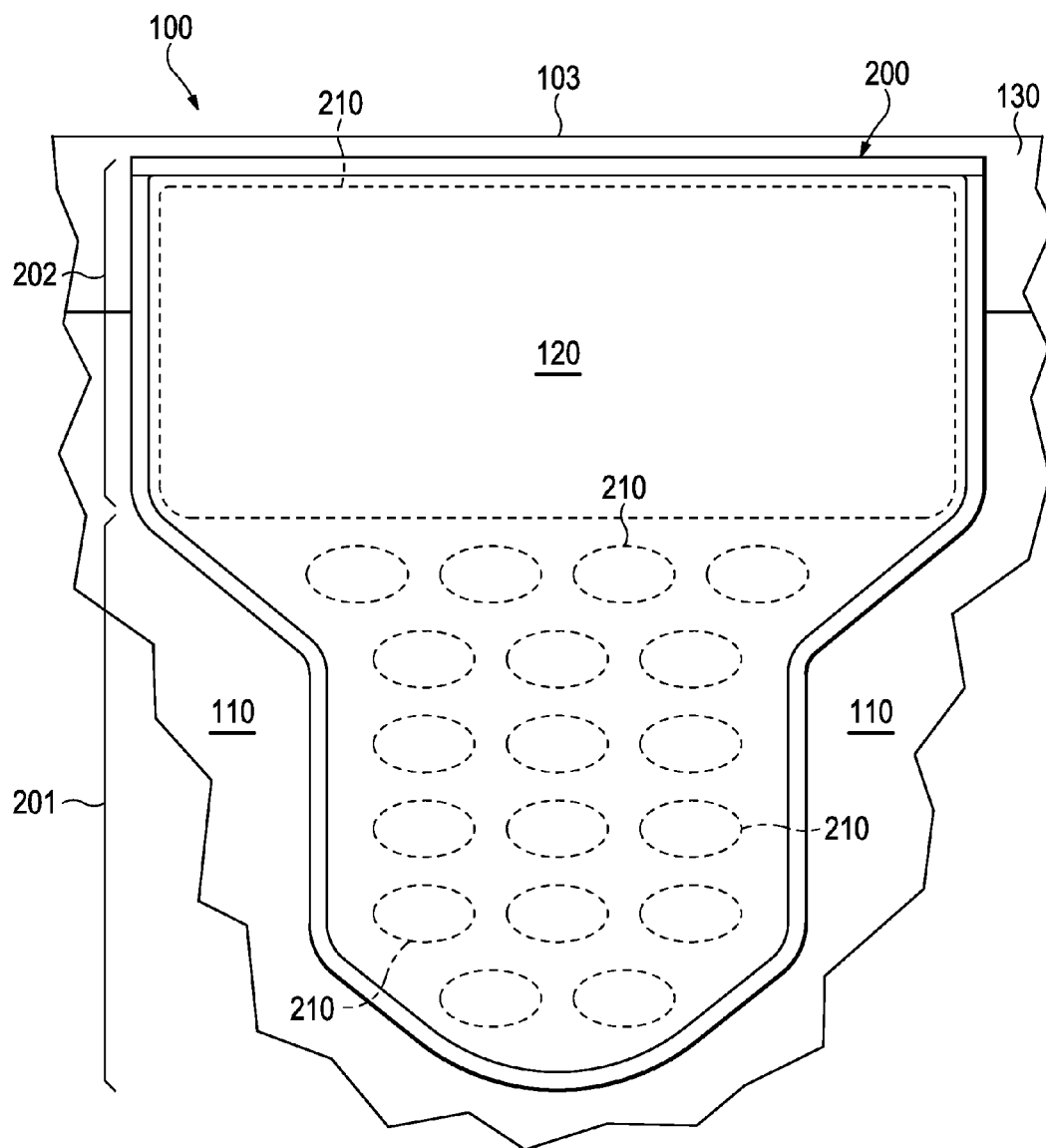


Figure 14B

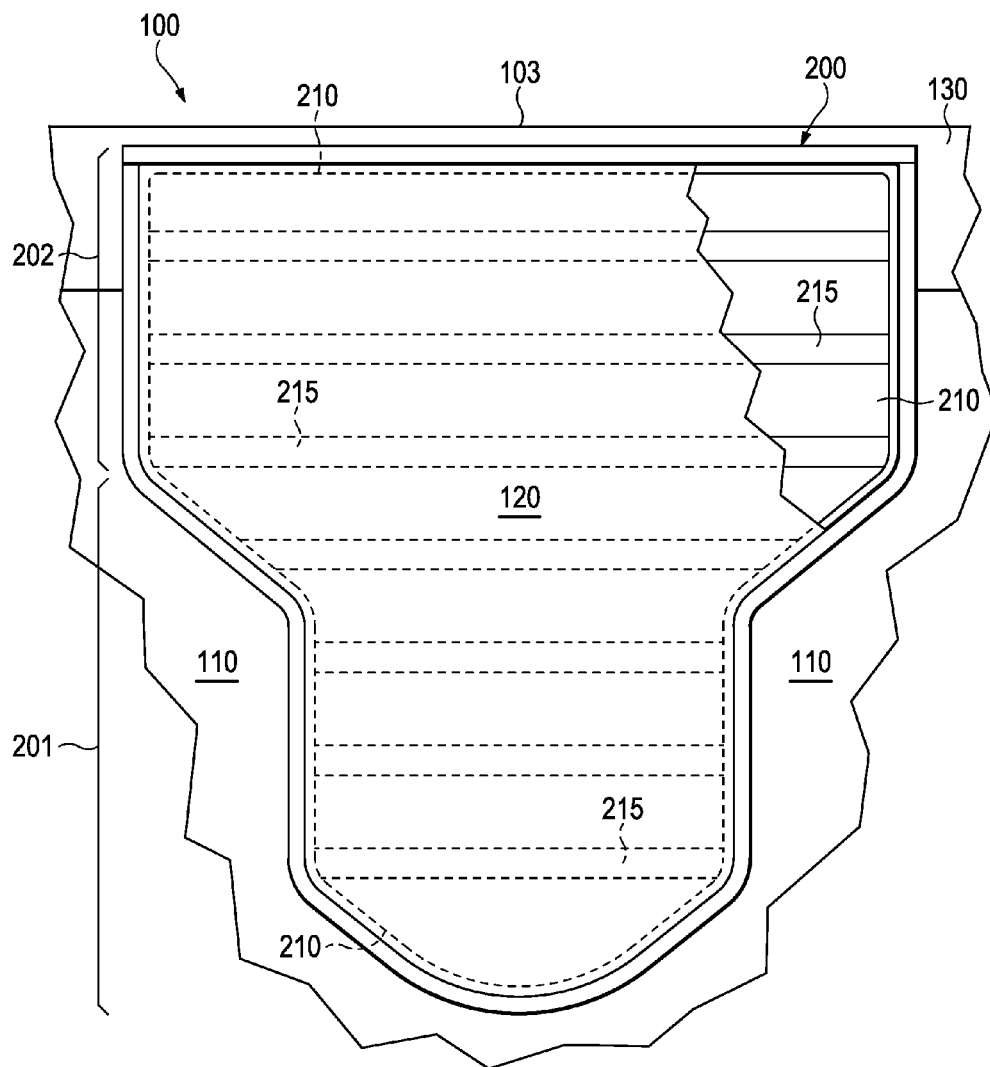


Figure 14C

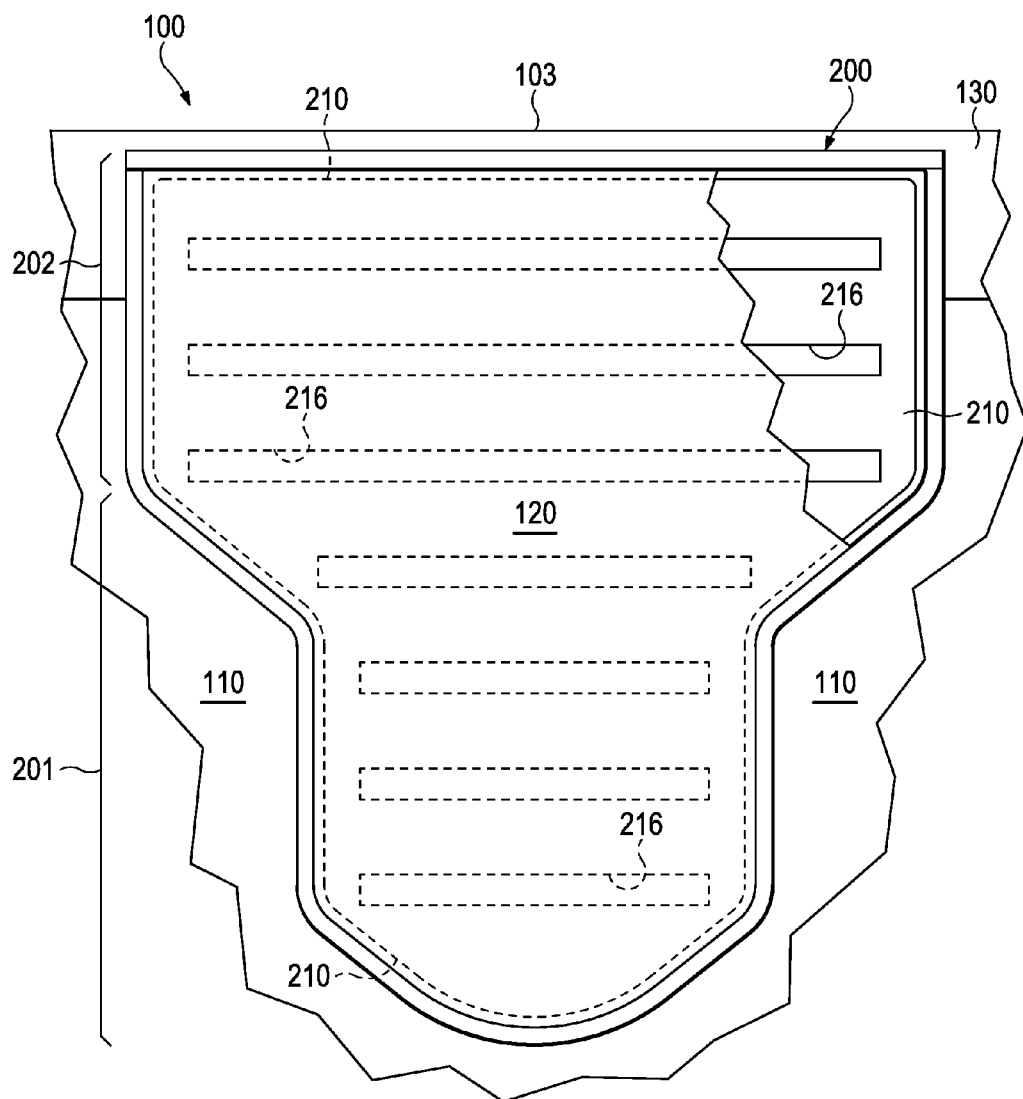


Figure 14D

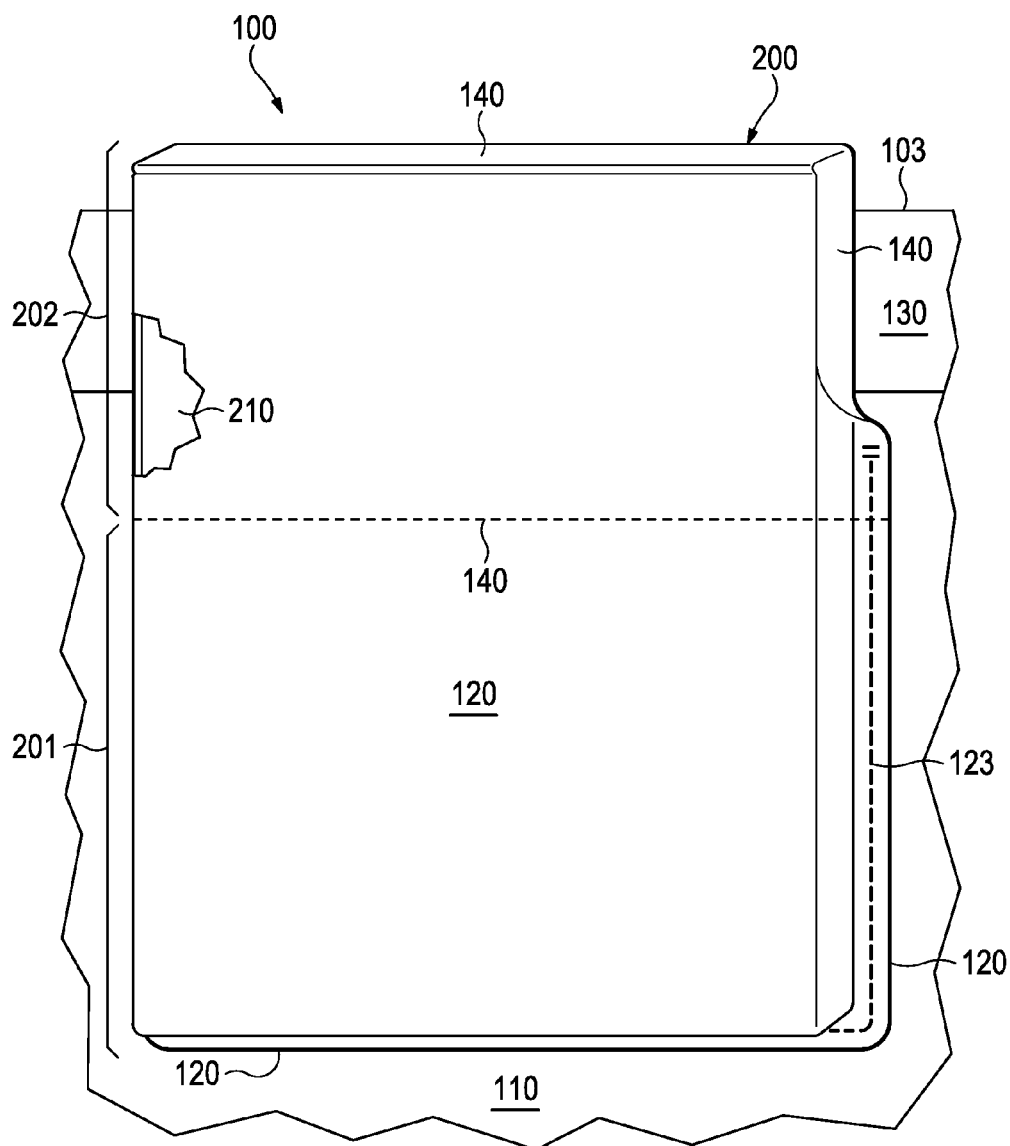


Figure 15

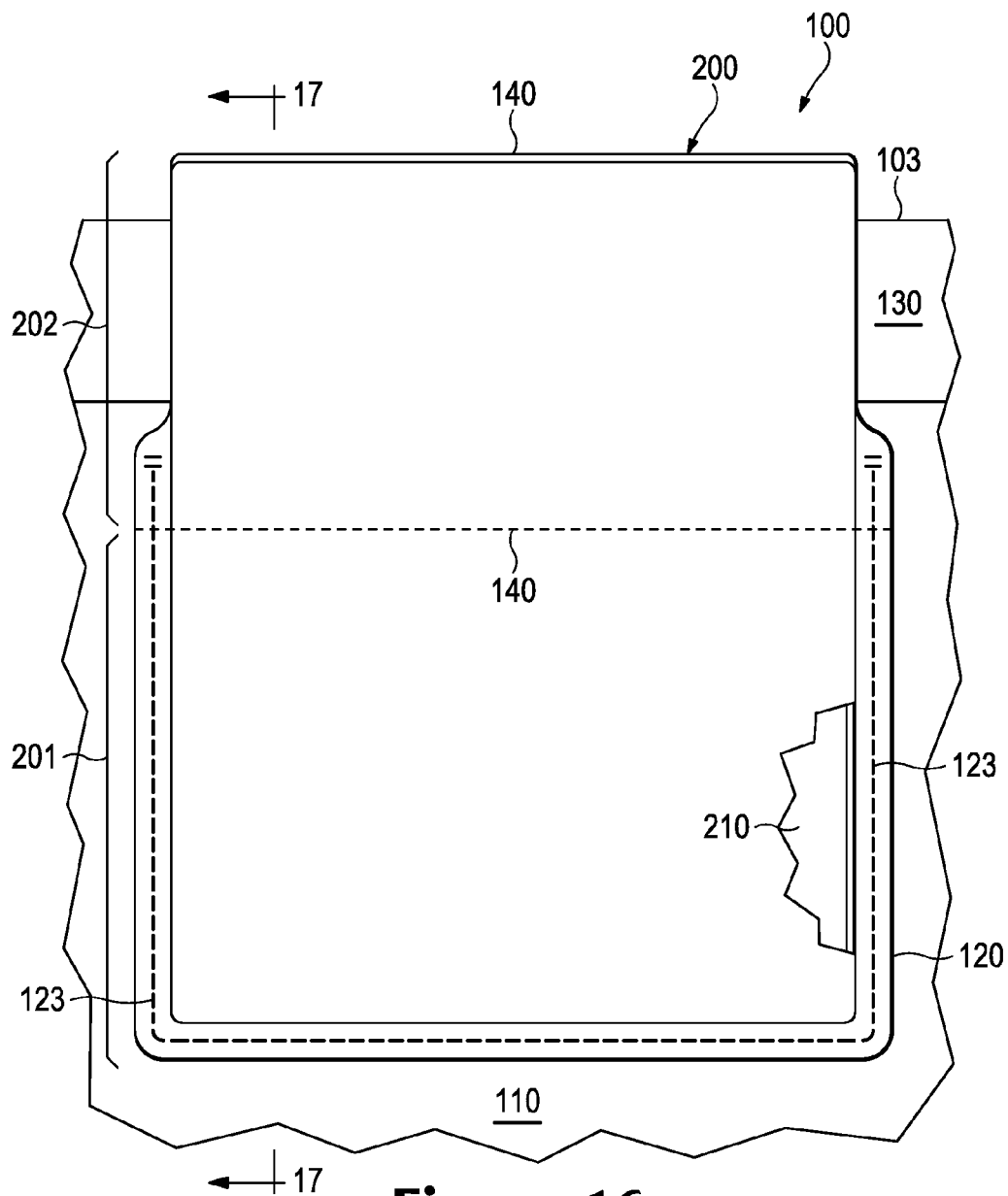
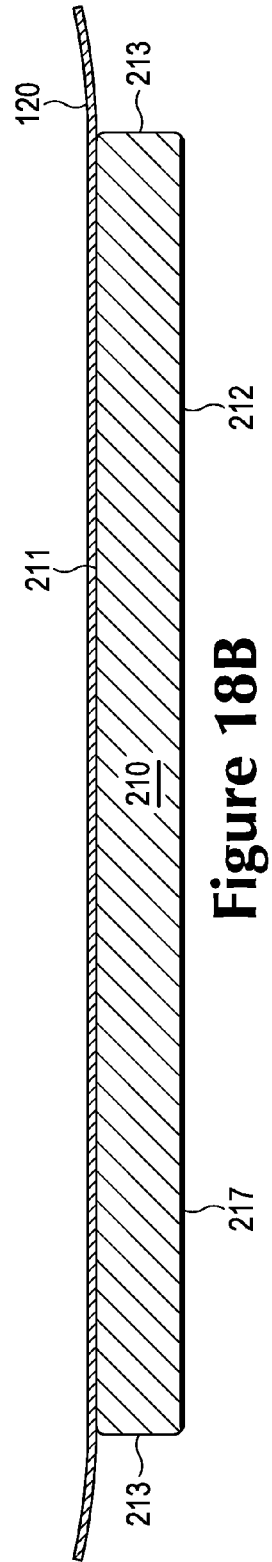
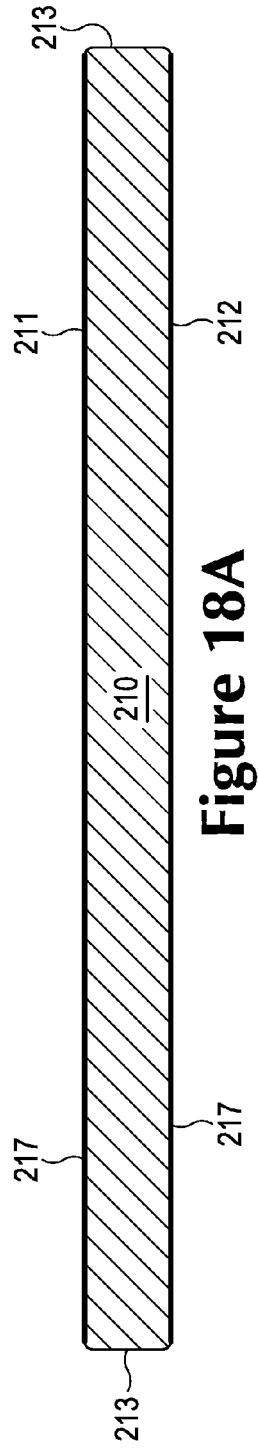
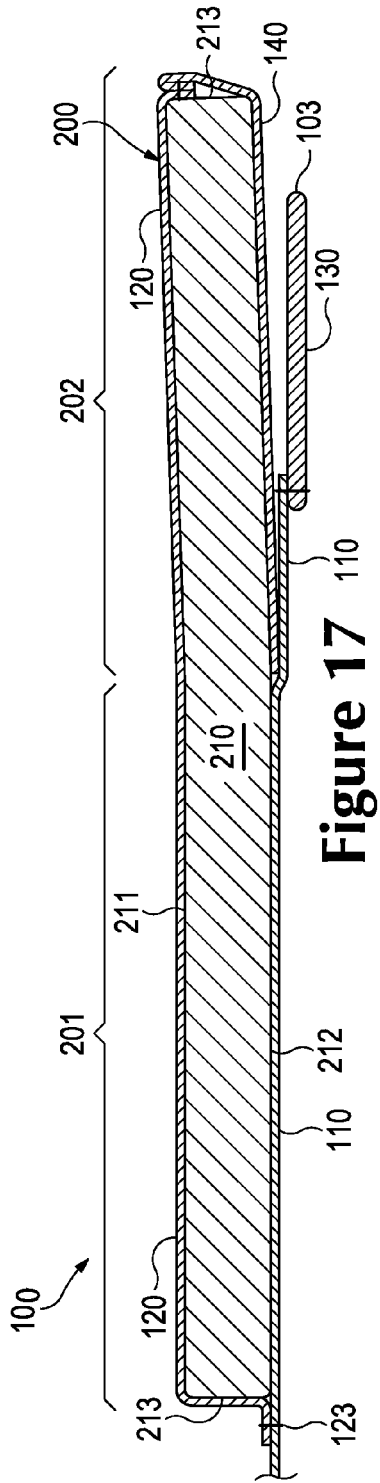


Figure 16



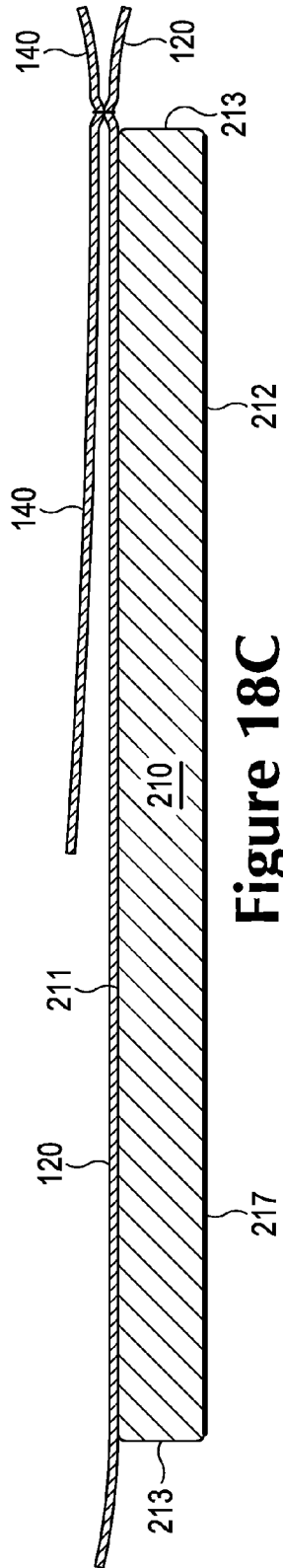


Figure 18C

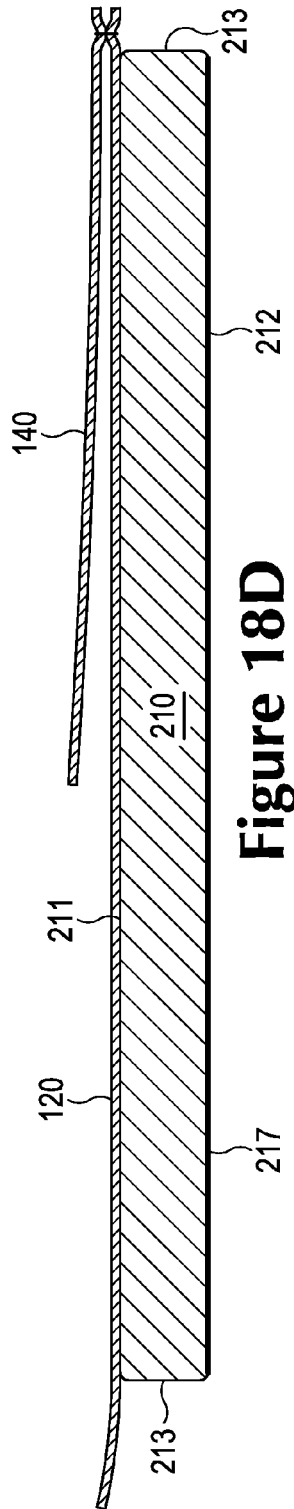


Figure 18D

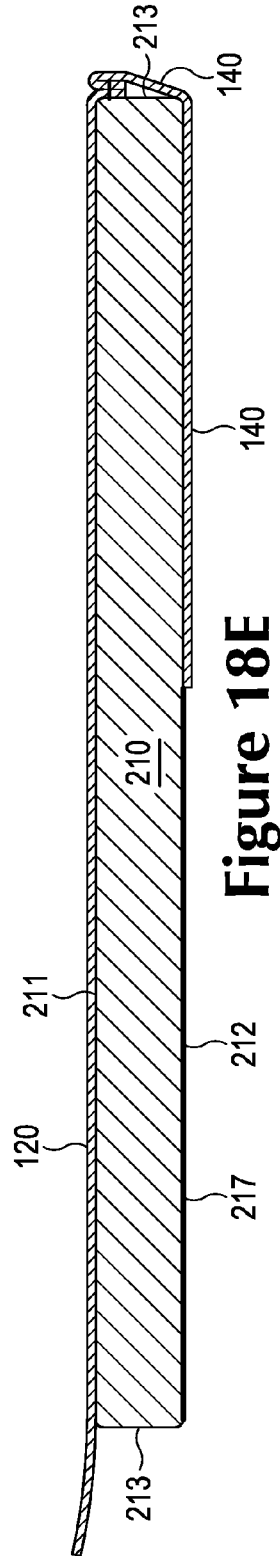
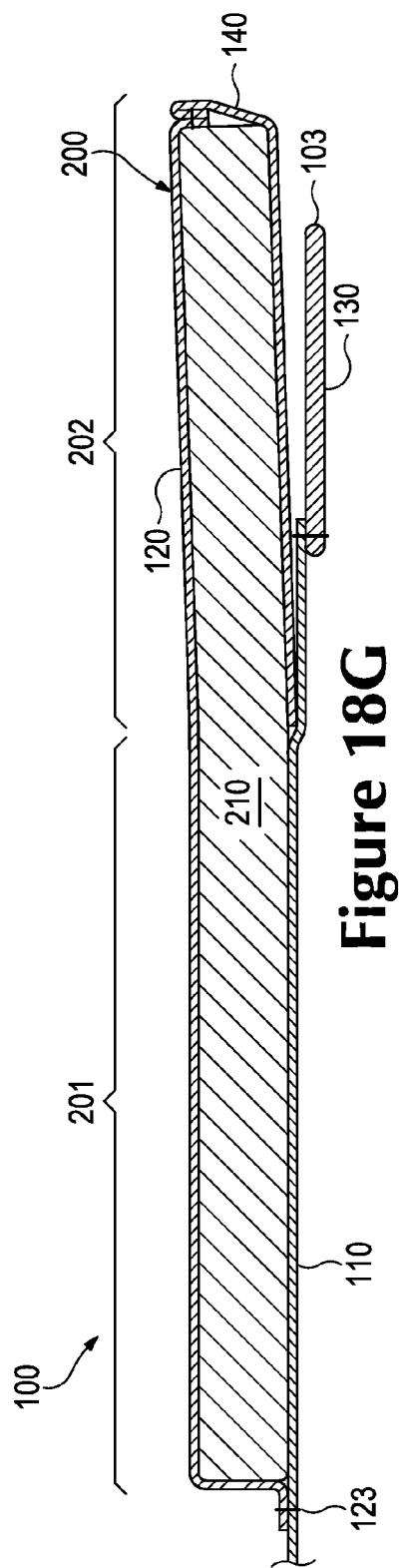
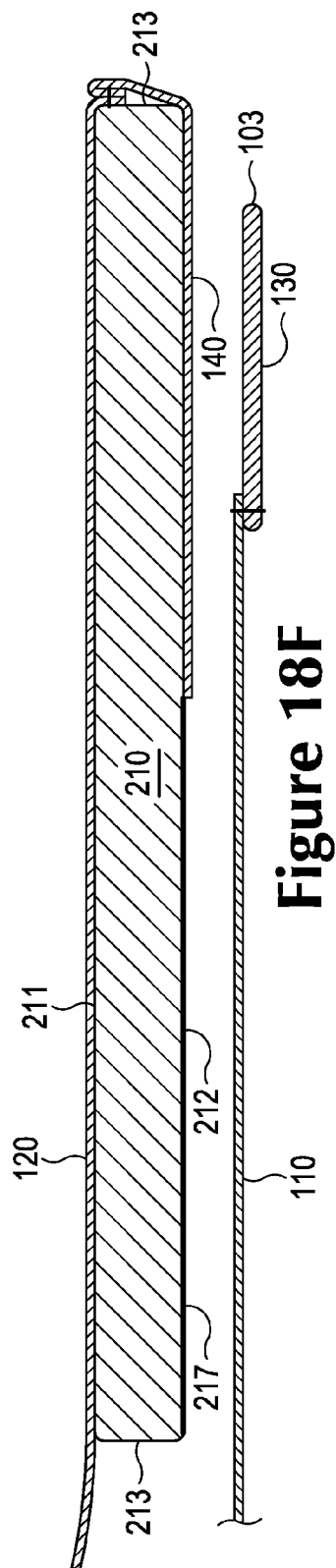


Figure 18E



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APPAREL INCORPORATING A PROTECTIVE ELEMENT

CROSS-REFERENCE TO RELATED APPLICATION

This U.S. patent application is a continuation of U.S. patent application Ser. No. 13/442,585, which was filed on Apr. 9, 2012 and entitled "Apparel Incorporating A Protective Element", which was allowed on Dec. 20, 2013, which application is a continuation-in-part application of U.S. Pat. No. 8,438,667, such prior U.S. patent application and patent being entirely incorporated herein by reference.

BACKGROUND

Protective elements or materials that impart padding, cushioning, or otherwise attenuate impact forces are commonly incorporated into a variety of products. Athletic apparel, for example, often incorporates protective elements that shield the wearer from contact with other athletes, equipment, or the ground. More specifically, pads used in American football and hockey incorporate protective elements that provide impact protection to various parts of a wearer. Helmets utilized during American football, hockey, bicycling, skiing, snowboarding, and skateboarding incorporate protective elements that impart cushioning to the head during falls or crashes. Similarly, gloves utilized in soccer (e.g., by goalies) and hockey incorporate protective elements that provide protection to the hands of a wearer. Cushioning elements may also be incorporated into bicycling shorts. Apparel that is utilized for generally non-athletic purposes may also incorporate cushioning elements, such as apparel that is worn for motorcycle riding and knee protectors for gardening or construction work.

SUMMARY

An article of apparel is disclosed below that includes a garment portion and at least one protective element. The garment portion and the protective element have a configuration that forms a gap, separation, or pleat structure. As an example, the gap, separation, or pleat structure may permit the protective element to move independent of other portions of the apparel, thereby enhancing a range of movement of the individual and the overall comfort of the apparel.

In one configuration, the garment portion may be formed from a plurality of joined textile elements and a band for extending around a portion of a wearer, the band forming an opening in the apparel. The protective element may be secured to at least one of the textile elements and unsecured to the band to form a gap between the protective element and the band.

The advantages and features of novelty characterizing aspects of the invention are pointed out with particularity in the appended claims. To gain an improved understanding of the advantages and features of novelty, however, reference may be made to the following descriptive matter and accompanying figures that describe and illustrate various configurations and concepts related to the invention.

FIGURE DESCRIPTIONS

The foregoing Summary and the following Detailed Description will be better understood when read in conjunction with the accompanying figures.

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FIG. 1 is a front elevational view of an individual wearing an article of apparel.

FIG. 2 is a front elevational view of the article of apparel.

FIGS. 3 and 4 are side elevational views of the article of apparel.

FIG. 5 is a rear elevational view of the article of apparel.

FIG. 6 is a perspective view of a portion of the article of apparel that includes a protective element.

FIG. 7 is an exploded perspective view of the portion of the article of apparel.

FIG. 8 is a plan view of the portion of the article of apparel.

FIGS. 9A-9C are cross-sectional views of the portion of the article of apparel, as defined by section lines 9A-9C in FIG. 8.

FIGS. 10A and 10B are cross-sectional views corresponding with FIG. 9A.

FIG. 11A-11F are plan views corresponding with FIG. 8 and depicting further configurations of the article of apparel.

FIGS. 12A-12C are cross-sectional views corresponding with FIG. 9A and depicting further configurations of the article of apparel.

FIGS. 13A-13D are plan views corresponding with FIG. 8 and depicting further configurations of the article of apparel.

FIGS. 14A-14D are plan views corresponding with FIG. 8 and depicting further configurations of the article of apparel.

FIG. 15 is a perspective view depicting a further configuration of the article of apparel.

FIG. 16 is a plan view of the configuration of the article of apparel depicted in FIG. 15.

FIG. 17 is a cross-sectional view of the article of apparel, as defined by section line 17 in FIG. 16.

FIGS. 18A-18G are cross-sectional views corresponding in location with FIG. 17 and depicting a process for manufacturing the article of apparel.

DETAILED DESCRIPTION

The following discussion and accompanying figures disclose various articles of apparel that incorporate protective elements. As discussed in greater detail below, the protective elements (e.g., foam pads, a plurality of foam elements) may bunch or otherwise compress to restrict movement of an individual wearing the apparel, particularly in the area of a joint (e.g., hip, knee, shoulder, elbow). A gap, separation, or pleat structure, for example, permits the protective element to move independent of other portions of the apparel at the joint, thereby enhancing a range of movement of the individual and the overall comfort of the apparel.

Apparel Configuration

With reference to FIG. 1, an individual 10 is depicted as wearing an article of apparel 100 with the general configuration of a pants-type garment, specifically a pair of shorts. In further configurations, concepts associated with apparel 100 may be incorporated into apparel having the configuration of a pair of pants, a shirt-type garment (e.g., long-sleeved shirt, short-sleeved shirt, jacket, coat, undershirt), headwear (e.g., hat, headband), a brace or covering (e.g., for a shoulder, elbow, knee, or ankle), or glove, for example. Although apparel 100 may be worn under other articles of apparel, apparel 100 may be worn alone, may be exposed, or may be worn over other articles of apparel. Apparel 100 may also be worn in combination with other pieces of equipment (e.g., athletic or protective equipment). Accordingly, the configuration of apparel 100 and the manner in which apparel 100 is worn by individual 10 may vary significantly.

Apparel 100 is depicted individually in FIGS. 2-5 as including a pelvic region 101 and a pair of leg regions 102 that extend outward from pelvic region 101. Pelvic region 101

corresponds with a pelvic area of individual **10** and covers at least a portion of the pelvic area when worn. An upper area of pelvic region **101** defines a waist opening **103** that extends around a waist of individual **10** when apparel **100** is worn. Leg regions **102** correspond with a right leg and a left leg of individual **10** and cover at least a portion of the right leg and the left leg when worn. Lower areas of leg regions **102** each define a thigh opening **104** that extends around a thigh of individual **10** when apparel **100** is worn. Additionally, apparel **100** includes an exterior surface **105** that faces away from individual **10** when apparel **100** is worn, and apparel **100** includes an opposite interior surface **106** that faces toward individual **10** and may contact individual **10** when apparel **100** is worn.

Each of pelvic region **101** and leg regions **102** include a variety of material elements (e.g., a base element **110**, a cover element **120**, a waistband **130**, as discussed below) that may be textiles and effectively form a garment portion of apparel **100**. That is, the material elements are joined (e.g., at seams through stitching, adhesive bonding, or thermal bonding) to impart the configuration of the shorts-type garment to apparel **100**. The textile elements also form areas for receiving various protective elements **200**, which are incorporated into various areas of apparel **100** to impart padding, cushioning, or otherwise attenuate impact forces. When apparel **100** is worn during athletic activities, for example, protective elements **200** may protect individual **10** from contact with other athletes, equipment, or the ground. With regard to apparel **100**, protective elements **200** are located in both of pelvic region **101** and leg regions **102** and are positioned, more specifically, to protect the hips, thighs, and tailbone of individual **10**.

Protective Element Configuration

A portion of apparel **100** that includes one of protective elements **200** is depicted in FIGS. 6-9C. In general, protective element **200** includes a plurality of pad components **210** and two frame components **220** that are located between base element **110** and cover element **120**. Although pad components **210** are secured to base element **110** and cover element **120**, frame component **220** is unsecured to each of base element **110**, cover element **120**, and pad components **210**. Base element **110** forms a majority of interior surface **106** and is located to contact individual **10** when apparel **100** is worn, with waistband **130** forming a smaller portion of interior surface **106**. Cover element **120** extends over pad components **210** and is joined to base element **110** around the periphery of pad components **210**. A combination of base element **110**, cover element **120**, and waistband **130** forms, therefore, a majority of exterior surface **105**.

Base element **110** and cover element **120** cooperatively form an outer surface or covering for protective element **200**. That is, base element **110** and cover element **120** cooperatively form a pocket or void, in which pad components **210** and frame component **220** are located. Whereas base element **110** is depicted as having a generally planar configuration, cover element **120** extends over pad components **210** and frame components **220** and also along sides of pad components **210** to join with base element **110** (e.g., through stitching, an adhesive, or thermal bonding). Although protective element **200** may be incorporated into apparel **100** in a variety of ways, cover element **120** may be positioned exterior of base element **110**. An advantage to this configuration is that protective element **200** protrudes outward from apparel **100**, rather than protruding inward and toward individual **10**. In some configurations of apparel **100**, however, protective element **200** may protrude inward.

Textile elements may be utilized for base element **110** and cover element **120** in many configurations of apparel **100**. As

examples, base element **110** and cover element **120** may be formed from knitted, woven, or non-woven textile elements that include rayon, nylon, polyester, polyacrylic, cotton, wool, or silk. Moreover, the textiles may be non-stretch, may exhibit one-directional stretch, or may exhibit multi-directional stretch, and the textiles may have a continuous configuration or may be mesh materials that define apertures. A variety of other materials may also be utilized for base element **110** and cover element **120**, including various polymer sheets, leather, and synthetic leather, for example. Combinations of these materials (e.g., a polymer sheet bonded to a textile) may also be utilized for base element **110** and cover element **120**. Although base element **110** and cover element **120** may be formed from the same material, each of base element **110** and cover element **120** may also be formed from different materials. Accordingly, a variety of materials are suitable for base element **110** and cover element **120**.

Each of pad components **210** includes a first surface **211**, an opposite second surface **212**, and a side surface **213** that extends between surfaces **211** and **212**. As discussed in greater detail below, protective element **200** includes an attached region **201** and a separated region **202**, as identified in each of FIGS. 6, 8, and 9A. In attached region **201**, pad components **210** are located between and secured to each of base element **110** and cover element **120**. That is, first surface **211** is secured to cover element **120** and second surface **212** is secured to base element **110**. In separated region **202**, however, pad components **210** are located between a folded or overlapping portion of cover element **120** and secured to only cover element **120**. That is, first surface **211** and second surface **212** are both secured to cover element **120**. As discussed in greater detail below, the folded or overlapping portion of cover element **120** in separated region **202** forms a gap, separation, or pleat structure that permits protective element **200** to move independent of other portions of apparel **100** at the hip joint, thereby enhancing a range of movement of individual **10** and the overall comfort of apparel **100**.

Although the shapes of pad components **210** may vary significantly, each of surfaces **211** and **212** are depicted as having an elliptical or generally elongate shape with rounded end areas, and side surface **213** extends in a generally straight fashion between surfaces **211** and **212**. Pad components **210** are spaced evenly from each other and arranged in offset rows. Given the shape of protective element **200**, various pad components **210** adjacent to the periphery of protective element **200** exhibit a truncated or partial configuration. Although pad components **210** exhibit a common or equal thickness, various pad components **210** may have different thicknesses. For example, the pad components **210** located at the periphery may have lesser thickness than pad components **210** located in central areas. In general, the thickness of pad components **210** may range from 3 to 30 millimeters or more. As a related matter, pad components **210** are depicted as being a plurality of separate elements for purposes of example, but may be interconnected, may be a single element, or may have a variety of other conventional or non-conventional configurations.

A variety of materials may be utilized for pad components **210**, including various polymer foam materials that return to an original shape after being compressed. Examples of suitable polymer foam materials for pad components **210** include polyurethane, ethylvinylacetate, polyester, polypropylene, and polyethylene foams. Moreover, both thermoplastic and thermoset polymer foam materials may be utilized. In some configurations of protective element **200**, pad components **210** may be formed from a polymer foam material with a varying density, or solid polymer or rubber materials may be

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utilized. Also, different pad components **210** may be formed from different materials, or may be formed from similar materials with different densities. The polymer foam materials forming pad components **210** attenuate impact forces to provide cushioning or protection. By selecting thicknesses, materials, and densities for each of the various pad components **210**, the degree of impact force attenuation may be varied throughout protective element **200** to impart a desired degree of cushioning or protection.

Within protective element **200**, frame components **220** are located between each of base element **110** and cover element **120**. In contrast with pad components **210**, frame components **220** are unsecured to each of base element **110** and cover element **120**, and frame components **220** are also unsecured to pad components **210**. This configuration permits frame components **220** to float or otherwise move relative to base element **110**, cover element **120**, and pad components **210**. Frame components **220** each have a first surface **221**, an opposite second surface **222**, and a side surface **223** extending between surfaces **221** and **222**. Additionally, frame components **220** define a plurality of apertures **224** having the general shape of pad components **210**. Given this configuration, frame components **220** extend around and between various pad components **210**. In areas where frame components **220** are present, the combination of pad components **210** and frame components **220** effectively form a foam layer within protective element **200**. Although the dimensions of apertures **224** may substantially match the dimensions of pad components **210**, frame components **220** may also be formed such that a gap extends between edges of apertures **224** and side surfaces **213** of pad components **210**. In some configurations, frame components **220** may be absent from protective element **200**.

Frame components **220** are located in two areas (e.g., an upper area and a lower area) of protective element **200**. As an alternative, one or both frame components **220** may extend (a) throughout protective element **200** and define apertures **224** that extend around all of pad components **210**, (b) around only centrally-located pad components **210**, or (c) around only peripherally-located pad components **210**. Referring to the cross-sectional views of FIGS. 9A-9C, for example, frame components **220** are depicted as exhibiting lesser thickness (i.e., distance between surfaces **221** and **222**) than each of pad components **210**. An advantage of this configuration is that frame components **220** may move relative to base element **110** and cover element **120**, thereby enhancing the flexibility of protective element **200**. As an example, frame components **220** may have a thickness of approximately 2 millimeters in a configuration wherein pad components **210** have a thickness of 7 millimeters. In other configurations, the thickness of frame components **220** may range from 1 to 20 millimeters or more. Although frame components **220** may exhibit lesser thickness than each of pad components **210**, frame components **220** may also be thicker than some or all of pad components **210**.

Any of the variety of materials discussed above as being suitable for pad components **210** may also be utilized for frame components **220**, including various polymer foam materials that return to an original shape after being compressed. Examples of suitable polymer foam materials for frame component **220** include polyurethane, ethylvinylacetate, polyester, polypropylene, and polyethylene foams. Moreover, both thermoplastic and thermoset polymer foam materials may be utilized. In some configurations of protective element **200**, frame components **220** may be formed from solid polymer or rubber materials.

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The compressible polymer foam materials forming pad components **210** and frame components **220** attenuate impact forces that compress or otherwise contact protective element **200**. When incorporated into apparel **100** or another article of apparel, for example, the polymer foam materials of pad components **210** and frame components **220** may compress to protect a wearer from contact with other athletes, equipment, or the ground. Accordingly, Protective element **200** may be utilized to provide cushioning or protection to areas of a wearer that are covered by protective element **200**.

In addition to attenuating impact forces, protective element **200** has an advantage of simultaneously providing one or more of breathability, flexibility, a relatively low overall mass, and launderability. When incorporated into an article of apparel, particularly apparel used for athletic activities, a wearer may perspire and generate excess heat. By utilizing a permeable textile for base element **110** and cover element **120** and also forming gaps between adjacent pad components **210** and areas between pad components **210** and frame components **220**, areas for air to enter the apparel and for moisture to exit the apparel are formed through protective element **200**. More particularly, air and moisture may pass through base element **110** and cover element **120**, between pad components **210** in areas where frame components **220** are absent, and between pad components **210** and frame components **220** in areas where frame components **220** are present to impart breathability to areas of the apparel having protective element **200**. Moreover, the materials and structure discussed above for protective element **200** impart flexibility and a low overall mass. Furthermore, the materials and structure discussed above permits protective element **200** to be laundered without significant shrinkage or warping, even when temperatures associated with commercial laundering processes are utilized. Accordingly, protective element **200** may simultaneously provide impact force attenuation, breathability, flexibility, a relatively low overall mass, and launderability to an article of apparel, such as apparel **100**.

Pleat Structure

In separated region **202**, apparel **100** has a configuration that permits protective element **200** to move independent of other portions of apparel **100** to enhance the range of movement of individual **10** and the overall comfort of apparel **100**. Referring to FIG. 9A, cover element **120** includes a first fold **121** and a second fold **122** that effectively form an S-shaped configuration in separated region **202**. Whereas first fold **121** wraps around various pad components **210** (i.e., from first surface **211** to second surface **212**), second fold **122** forms an overlapping area in cover element **120** and extends along base element **110** to join with waistband **130**. Although pad components **210** are present within first fold **121**, pad components are absent from an area within second fold **122**. Cover element **120** is secured to each first surface **211** of the various pad components **210**. Due to first fold **121**, cover element **120** is also secured to second surface **212** in at least separated region **202**. In attached region **201**, however, base element **110** is secured to second surface **212** of the various pad components **210**.

An upper edge of protective element **200** is located adjacent to waistband **130**, which is formed of a stretchable material and extends around individual **10**. Often, waistband **130** extends above the hip joint of individual **10**, which places a portion of protective element **200** over the hip joint. More particularly, the portion of protective element **200** in separated region **202** is located over the hip joint, whereas the portion of protective element **200** in attached region **201** protects the hip and areas of the leg around the hip. A portion of cover element **120** is secured to waistband **130** and extends

away from waistband 130. Although areas of cover element 120 are secured to surfaces 211 and 212 of pad components 210, the portion secured to waistband 130 and extending away from waistband 120 is unsecured to pad components 200.

The overall configuration discussed above forms pleat structure in apparel 100 that allows portions of protective element 200 to move independently. More particularly, the overall configuration of cover element 120 (i.e., through folds 121 and 122 and the configuration of cover element 120 discussed above) allows protective element 200 to move or flex in separated region 202. As a first example, which is depicted in FIG. 10A, a portion of protective element 200 may flex to form a gap or separation between protective element 200 and other areas of apparel 100. That is, the pleat structure formed by cover element 120 allows the portion of protective element 200 in separated region 202 to flex, thereby forming the gap or separation. As a second example, which is depicted in FIG. 10B, the portion of protective element 200 in separated region 202 may move or slide over waistband 130 and areas of base element 110 and cover element 120. If, for example, protective element 200 is pushed by an upward force, then the pleat structure in apparel 100 would allow protective element 200 to slide over waistband 130, rather than bunching or compressing. Given that protective element 200 is located at a hip joint of individual 10, the flexing to form a gap or separation and the sliding permits protective element 200 to move independent of other portions of apparel 100, thereby enhancing a range of movement of individual 10 and the overall comfort of apparel 100.

Further Protective Element Configurations

Aspects of apparel 100 may vary depending upon the intended use for apparel 100 and the product in which cushioning element 200 is incorporated. Moreover, changes to the dimensions, shapes, and materials utilized within protective element 200 may vary the overall properties of protective element 200. That is, by changing the dimensions, shapes, and materials utilized within protective element 200, the compressibility, impact force attenuation, breathability, flexibility, and overall mass of protective element 200 may be tailored to specific purposes or products.

Further configurations of the portion of apparel 100 that includes protective element 200 are depicted in FIGS. 11A-11E. Referring to FIG. 11A, frame components 220 are absent from protective element 200. Aspects relating to pad components 210 may also vary. For example, the various pad components 210 have hexagonal shapes in FIG. 11B, but may also be circular, rectangular, elliptical or any other regular or irregular shape. In another configuration, as depicted in FIG. 11C, pad components 210 may be replaced by a single element of a foam material. The overall shape of protective element 200 may also vary significantly. Referring to FIG. 11D, protective element has a rectangular shape, but may also be circular, hexagonal, elliptical or any other regular or irregular shape. The location of protective element 200 may also vary. As depicted in FIGS. 11E and 11F, protective element 200 may be spaced from waistband 130 or may cover a portion of waistband 130.

The manner in which the pleat structure is formed may also vary in apparel 100. Referring to FIG. 12A, for example, cover element 120 forms first fold 121, but an end of cover element 120 is secured to base element 110. In this configuration, therefore, second fold 122 is absent. As another example, FIG. 12B discloses a configuration wherein cover element 120 extends downward along side surface 223, but is absent from second surface 212, and base element 110 is unsecured to second surface 212 in separated region 202. As

a further example, depicts a configuration wherein base element 110 terminates and is joined to cover element 120 as second fold 122. In each of these configurations, a gap, separation, or pleat structure is formed that permits protective element 200 to move independent of other portions of apparel 100, thereby enhancing a range of movement of individual 10 and the overall comfort of the apparel 100.

Unitary Pad Component Configurations

The plurality of pad components 210 are replaced by a single or unitary element of a foam material in the example of FIG. 11C. That is, protective element 200 includes a single pad component 210, rather than multiple, separate pad components 210. Although either configuration may be utilized for many configurations of apparel 100, an advantage to utilizing a unitary pad component 210 relates to the stability or structural integrity of protective element 200. As the size of separated region 202 increases, the propensity for separated region 202 to droop, sag, or otherwise bend away from apparel 100 increases due to a corresponding increase in flex. By incorporating a unitary pad component 210 into protective element 200, however, separated region 202 may be more likely to lay against apparel 100. In effect, utilizing a single or unitary pad component 210 in at least separated region 202 imparts the advantage of decreasing flexibility and increasing the stability of protective element 200. Moreover, the increased stability may ensure that protective element 200 lays against individual 10 when apparel 100 is worn.

Various examples of protective element 200 that include a unitary pad component 210 will now be discussed. Referring to FIG. 13A, a configuration that is similar to FIG. 11F and includes a unitary pad component 210 is depicted. In this configuration, protective element 200 extends upward and covers a portion of waistband 130. Moreover, separated region 202 is larger and extends upward (i.e., toward waist opening 103) to a greater degree than in other configurations discussed above. That is, the height of separated region 202 is greater than in the other configurations. Given that pad component 210 is formed from a single or unitary element of a foam material, however, separated region 202 may be more likely to lay against waistband 130 or other portions of apparel 100. Referring to FIG. 13B, the height of separated region 202 is increased further and an upper edge of protective element 200 is located below and proximal to waist opening 103. Similarly, the height of separated region 202 is increased even further in FIG. 13C and an upper edge of protective element 200 is located above and proximal to waist opening 103. In another example, which is depicted in FIG. 13D, attached region 201 extends to an area that is proximal waistband 130, and protective element 200 extends beyond waist opening 103. Accordingly, by utilizing a single or unitary pad component 210 in at least separated region 202, protective element 200 may cover waistband 130 to various degrees, and even extend to or past waist opening 103, while remaining separated from waistband 130.

Whereas utilizing multiple pad components 210 imparts the advantages of breathability and flexibility to protective element 200, utilizing a single or unitary pad component 210 imparts the competing advantage of decreasing the flexibility and increasing the stability of protective element 200 in at least separated region 202. Various methods may, therefore, be utilized to increase flexibility and breathability of at least attached region 201 when a single or unitary pad component 210 is utilized. Referring to FIG. 14A, for example, a plurality of apertures 214 extend through pad component 210 and may enhance breathability and flexibility, while ensuring that the portion of pad component 210 located within separated region 202 remains sufficiently stable. As another example,

FIG. 14B depicts a configuration wherein (a) a larger pad component 210 is located in separated region 202 and an upper portion of attached region 201 and (b) a plurality of separate pad components 210 are located in a remainder of attached region 201. In this configuration, the larger pad component 210 imparts stability to separated region 202, whereas the plurality of separate pad components 210 enhance both breathability and flexibility in attached region 201. Referring to FIG. 14C, pad component 210 includes a plurality of indentations, flex regions, or grooves 215 that extend into a surface (e.g., first surface 211) of pad component 210, extend across pad component 210, and are located in both of regions 201 and 202. Although grooves 215 may extend across substantially all of pad component 210, grooves 215 may also extend across a portion of pad component 210. A similar configuration is depicted in FIG. 14D, wherein a plurality of holes, apertures, or voids 216 extend through pad component 210, extend across a majority of a width of pad component 210, and are located in both of regions 201 and 202. Grooves 215 and voids 216 also enhance both breathability and flexibility, while retaining sufficient stability in separated region 202. In some configurations, two or more of apertures 214, grooves 215, and voids 216 may be utilized in pad component 210. Moreover, different areas of pad component 210 may include different combinations and configurations of apertures 214, grooves 215, and voids 216 to impart different degrees of breathability, flexibility. Further examples of structures similar to protective element 200 that include various configurations of grooves and voids, as well as combinations of grooves and voids, may be found in co-pending U.S. patent application Ser. No. 13/442,537, which was filed in the U.S. Patent and Trademark Office on 9 Apr. 2012 and entitled Articles Of Apparel Incorporating Cushioning Elements, such prior U.S. patent application being entirely incorporated herein by reference.

Cover Element Configuration

Another configuration of the portion of apparel 100 that includes one of protective elements 200 is depicted in FIGS. 15-17. As with the various configurations discussed above with reference to FIGS. 13A-14D, for example, protective element 200 (a) includes a single or unitary element forming pad component 210, but could also be formed to have various separate elements of polymer foam material, (b) extends over or otherwise covers a portion of waistband 130, and (c) includes both attached region 201 and separated region 202. In contrast with the various configurations discussed above, however, apparel 100 includes another material element, a supplemental cover element 140, that extends over and is secured to portions of second surface 212 and side surface 213. Details concerning the structure of supplemental cover element 140 and the manner in which supplemental cover element 140 is incorporated into apparel 100 will be discussed in detail below.

Cover element 120 is secured to a majority of first surface 211 and extends along a portion of side surface 213 that is primarily located in attached region 201. In the area around side surface 213, cover element 120 is joined with base element 110 through stitching 123, although other joining methods may be utilized. At the interface of first surface 211 and side surface 213 in separated region 202, cover element 120 is joined with supplemental cover element 140, which (a) extends along a portion of side surface 213 that is primarily located in separated region 202 and (b) is secured to a portion of second surface 212 that is also primarily located in separated region 202. In effect, supplemental cover element 140

extends between pad component 210 and waistband 130, as depicted in FIG. 17, and forms the space, gap, or unconnected area in separated region 202.

An example of a process that may be utilized to form apparel 100 with supplemental cover element 140 will now be discussed. Referring to FIG. 18A, pad component 210 is depicted as including a laminate material 217 on both of surfaces 211 and 212. Laminate material 217 may be a thermoplastic polymer material or thermally-activated adhesive, for example that bonds with textiles or other materials, such as elements 110, 120, and 140. Once pad component 210 is properly prepared, cover element 120 may be joined to first surface 211 with laminate material 217. As an example, cover element 120 and pad component 210 may be placed between platens of a heated press and compressed to effectively join cover element 120 to pad component 210.

Continuing with the process, supplemental cover element 140 is positioned adjacent to cover element 120 and joined (e.g., through stitching), as depicted in FIG. 18C. Additionally, excess end areas of cover element 120 and supplemental cover element 140 are trimmed, as depicted in FIG. 18D. With cover elements 120 and 140 joined and trimmed, supplemental cover element 140 is positioned around pad component 210 and adjacent to portions of side surface 213 and second surface 212, as depicted in FIG. 18E. Moreover, supplemental cover element 140 is joined to second surface 212 with laminate material 217 (e.g., with the heated press).

At this stage of the process, cover elements 120 and 140 are secured to pad component 210. More particularly, cover element 120 is secured to first surface 211 and supplemental cover element 140 is secured to second surface 212. This construct is then positioned relative to base element 110 and waistband 130, as depicted in FIG. 18F. In positioning the components, portions of pad component 210 extend over waistband 130 and beyond waist opening 103. Once positioned, base element 110 is joined (e.g., with the heated press) to exposed areas of second surface 212, as depicted in FIG. 18G. Through this process, base element 110 is joined to areas of pad component 210 located in attached region 201, whereas supplemental cover element 140 is joined to areas of pad component located in separated region 202. Moreover, the presence of supplemental cover element 140 ensures that a space, gap, or unconnected area is formed in separated region 202.

The process for forming apparel 100 with supplemental cover element 140 discussed above provides an example of a suitable manufacturing method. Various modifications to the process or alternative processes may also be utilized. For example, in FIGS. 18E and 18F, supplemental cover element 140 is joined to second surface 212. As an alternative, supplemental cover element 140 may remain unjoined at this stage, and both base element 110 and supplemental cover element 140 may be joined to second surface 212 through a single bonding operation. As another example, although stitching is depicted as joining cover elements 120 and 140 in FIG. 18C, other securing methods may also be utilized. Furthermore, the extent to which pad component 210 extends over waistband 130 and beyond waist opening 103 may also vary such that, for example, (a) pad component 210 does not extend beyond waist opening 103, as in FIGS. 13A and 13B or (b) pad component 210 does not extend over waistband 130, as in FIG. 11C. Accordingly, the process for forming apparel 100 with supplemental cover element 140 and the resulting structure of protective element 200 may vary.

Based upon the above discussion, portions of protective element 200 may extend over or beyond waistband 130 to protect areas of individual 10. Although disclosed in connec-

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tion with apparel **100**, a similar concept may be applied to other types of apparel. For example, a separated portion of a protective element may extend above a band forming a neck opening in a shirt to impart protection to the neck. In other configurations, a separated portion of a protective element may extend over a joint (e.g., knee, shoulder) to impart flexibility and force attenuation. Accordingly, the various concepts discussed above may be applied to a variety of apparel types and may be incorporated in various ways to enhance apparel.

The invention is disclosed above and in the accompanying figures with reference to a variety of configurations. The purpose served by the disclosure, however, is to provide an example of the various features and concepts related to the invention, not to limit the scope of the invention. One skilled in the relevant art will recognize that numerous variations and modifications may be made to the configurations described above without departing from the scope of the present invention, as defined by the appended claims.

The invention claimed is:

1. An article of apparel comprising:

a waistband that forms a waist opening and that is stretchable;

at least a first textile element joined to the waistband;

second textile element attached to at least part of the first textile element; and

a protective element formed from a compressible material and located between the first textile element and the second textile element, wherein the protective element is coupled to the first textile element, wherein a portion of the protective element overlaps the waistband, and wherein at least a portion of the portion of the protective element is unsecured and separate from the waistband.

2. The article of apparel recited in claim **1**, wherein the protective element includes a plurality of grooves that extend into a surface of the pad component and wherein at least one groove of the plurality of grooves is at least partially positioned proximate an edge of the protective element.

3. The article of apparel recited in claim **1**, wherein the protective element includes a plurality of voids that extend through the pad component.

4. The article of apparel recited in claim **3**, wherein the plurality of voids extends across a majority of the protective element.

5. The article of apparel recited in claim **1**, wherein the protective element extends to an area that is proximal the waist opening formed by the waistband.

6. The article of apparel recited in claim **1**, wherein the protective element extends beyond the waist opening formed by a waistband.

7. The article of apparel recited in claim **1**, wherein a single protective element is located between the first textile element and the second textile element.

8. The article of apparel recited in claim **1**, wherein the first textile element is secured to the second textile element around substantially an entire perimeter of the pad component.

9. The article of apparel recited in claim **1**, wherein the protective element has a first side and an opposite second side, and wherein the first side faces the first textile element and the second side faces the second textile element, and wherein the first side is at least partially secured to the first textile element and the second side is at least partially secured to the second textile element.

10. The article of apparel recited in claim **9**, wherein a first portion of the first textile element is coupled to the waistband and wherein a second portion of the first textile element

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overlaps with the waistband and is unsecured to the waistband, the second portion of the first textile element layered between the protective element and the waistband.

11. The article of apparel recited in claim **10**, wherein the first portion of the first textile element that is coupled to the waistband is also coupled to the second textile element.

12. The article of apparel recited in claim **11**, wherein the first portion of the first textile element is stitched to the second textile element.

13. An article of apparel comprising:

a waistband that forms a waist opening and that is stretchable to change a size of the waist opening;

a perforated textile material and another textile material, at least one of the perforated textile material and the other textile material being secured to the waistband;

a pad component formed from a compressible material, wherein the pad component is layered between the perforated textile material and the other textile material, wherein the pad component has a first side and a second side, and wherein the first side faces towards the perforated textile material and the second side faces towards the other textile material; and

a bonding layer between the pad component and the perforated textile material, the bonding layer coupling the first side to the perforated textile material, wherein a portion of the pad component overlaps the waistband, and wherein at least a portion of the portion of the pad component is unsecured and separate from the waistband.

14. The article of apparel recited in claim **13**, wherein the bonding layer includes a thermoplastic polymer material.

15. The article of apparel recited in claim **13**, wherein the bonding layer includes a thermally-activated adhesive.

16. The article of apparel recited in claim **13** wherein the a first portion of the perforated textile material is coupled to the waistband and wherein a second portion of the perforated textile material overlaps with the waistband and is unsecured to the waistband, the second portion of the perforated textile material layered between the bonding layer and the waistband.

17. The article of apparel recited in claim **13**, wherein a first portion of the other textile material is coupled to the waistband and wherein a second portion of the other textile material overlaps with the waistband and is unsecured to the waistband, the second portion of the other textile material layered between the bonding layer and the waistband.

18. The article of apparel of claim **13**, wherein the pad component includes a plurality of grooves that extends into a surface of the pad component.

19. The article of apparel recited in claim **18**, wherein the surface of the pad component faces towards and is bonded to the perforated textile material by the bonding layer.

20. An article of apparel comprising:

a waistband that forms a waist opening and that is stretchable to change a size of the waist opening;

at least a first textile element joined to the waistband;

a second textile element attached to at least part of the first textile element; and

a protective element formed from a compressible material and located between the first textile element and the second textile element, wherein the protective element is coupled to the second textile element, wherein a portion of the protective element overlaps the waistband, and wherein at least a portion of the portion of the protective element is unsecured and separate from the waistband.